TROPICAL DISEASES BUREAU.

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DISEASES DUE TO PROTOZOAN PARASITES.

JACK (Rupert W.). **Natural Transmission of Trypanosomiasis (*T. pecorum* Group) in the Absence of Tsetse-Fly.**—*Bull. Entom. Res.* 1917. Aug. Vol. 8. Part 1. pp. 35–41. With 2 maps.

In this article Jack records a series of observations made in Southern Rhodesia during the past seven years, tending to show that in certain conditions the transmission of trypanosomiasis has occurred more frequently in the absence of the tsetse fly than has been generally recognised. Details are thus given concerning limited outbreaks in six separate localities, situated at certain considerable distances from either the Gatooma tsetse area or the fly areas in the Sebungwe District. No tsetse flies were at any time discoverable in these localities. Four of these outbreaks involved cattle of which a certain number were used for draught purposes and had travelled over considerable distances, in some cases either in close proximity to or even into a known tsetse fly area; the remaining two outbreaks involved groups of swine. The situation of the infected centres and the routes taken by the draught oxen are carefully traced on the maps; the trypanosome was identified in each case by BEVAN (Ll. E. W.).

In discussing these outbreaks the author calls special attention to the following points:—

"(1) In all cases the outbreak attained its height during the spring and summer months (October–April).

"(2) In all cases, in connection with which sufficient time has elapsed for such observation, there has been no recrudescence of the disease in the following season, although susceptible animals have still been kept in the same locality." (In a footnote the author points out that this is contrary to the experience in Barotseland and Portuguese East Africa.)

"(3) In all cases infection occurred only amongst animals that were herded together."

The time of the year in which the maximum number of cases are noted does not give any considerable assistance in identifying the species of fly responsible for the transmission of the disease as, apart from *Glossina morsitans* and certain species of Hippobosca, all the common blood-sucking flies are very much scarcer in winter than in summer. The most probable agents are included in the following

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species :—*Tabanus fuscipes*, *T. taeniola*, various species of Haematopota especially *H. pertinens*, *Stomoxys calcitrans*, Lyperosia, and mosquitoes. Of these *S. calcitrans* and mosquitoes were the only agents that were everywhere abundant throughout the season over which infection extended. The power of mechanical transmission need not necessarily, however, be confined to one species or to one family.

In addition the author maintains that the disease is not readily transmissible under Southern Rhodesian conditions by the above agents from chronic cases that live over until the rains or recover, and also that the transmitting agents are not capable of perpetuating the disease indefinitely or are only capable of doing so under exceptional circumstances. Experience in the territory where "fly-struck" cattle have been freely moved into fly-free areas has shown that "these movements have not resulted in *establishing* trypanosomiasis in any area away from the fly belts." It follows also that the method of transmission in the outbreaks described is of a mechanical and not of a cyclical nature and that the segregation of infected animals (on showing a rise in temperature) would in the absence of tsetse effectively check the spread of the disease.

"In no instance as yet recorded in Southern Rhodesia, however, can Glossina be definitely disassociated from the *inception* of the outbreak. The main point is, that the herding of 'fly-struck' cases with healthy animals is a practice attended with danger, especially in the spring and summer months."

CHAMBERS (F.). **Note on the Transmission of Animal Trypanosomiasis in Northern Rhodesia by Blood-Sucking Flies other than Glossina** —*Vet. Review.* 1917. Aug. Vol. 1. No. 3. pp. 222–227.

In this note Chambers summarises the observations and experiments of a number of authors who have reported the occurrence of trypanosomiasis in Northern Rhodesia and adjoining territories definitely known to be free of the tsetse fly. Some of these reports have already been extracted in this *Bulletin*. The author places no observations of his own on record.

In 1905 a chronic disease made its appearance amongst cattle grazing on the northern banks of the Zambesi; the disease was confined to an area extending from Livingstone to Sesheke and was popularly called Sesheke sickness. A detailed reference is made to G. E. OWEN's manuscript report (1912–1913) showing that the disease was caused by a trypanosome believed to be of the *dimorphon* type [this *Bulletin*, Vol. 2, No. 4, p. 167]. OWEN regarded the disease as being transmitted mechanically by means of Tabanidae.

KINGHORN and YORKE (1912) recorded a case of trypanosomiasis of a cow in a certain locality in North-Eastern Rhodesia, where no tsetse flies were found but Stomoxys and Tabanidae were common [this *Bulletin*, Vol. 1, No. 2, p. 79]. HART (R. L. L.) (1911) similarly observed cattle affected with trypanosomiasis on a tsetse-free farm in the Abercorn district; Pangonia and *Stomoxys nigra* were shown to be possible transmitters. MONTGOMERY and KINGHORN (1907) suggested that *Stomoxys calcitrans* and Lyperosia were capable of acting as

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transmitters. Failure to effect cyclical transmission by means of Tabanidae and ticks was demonstrated by KINGHORN and YORKE (1906) in the case of *T. rhodesiense*. Reference is also made to the failure to transmit *T. gambiense* by means of *Stomoxys nigra* and *S. calcitrans* by DUKE (1913) [this *Bulletin*, Vol. 1, No. 4, p. 215].

JOWETT (1910–11) described the occurrence of trypanosomiasis in a tsetse-free area in Portuguese East Africa after the introduction into a herd of some animals that had probably passed through a tsetse belt. Positive results were obtained in one feeding experiment with Stomoxys and Haematopota. ROGERS as long ago as 1901 showed that Tabanidae were capable of transmitting *T. evansi* within 24 hours after biting an infected animal.

DOEVE (W. C. A.). **Mededeelingen betreffende Surra.** [Information regarding Surra.]—*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 1. pp. 4–15.

This article deals with the clinical course of naturally contracted surra in buffaloes. No information was obtainable regarding the period of incubation as experiments dealing with artificial infection were not performed. The disease is stated to commence as an acute infection, for this is the type observed in animals introduced into surra-infected districts from clean districts. During this acute preliminary stage the animals always show a rise of temperature (39° to 40° C.), erect hair and disturbances in connection with the digestive tract,—decreased appetite, irregularities and careless chewing of the cud, and alternating constipation and diarrhoea; the conjunctiva is markedly congested and keratitis is sometimes observed. Sometimes the animals show symptoms of complete blindness without any apparent abnormality in connection with the eyes. The buffaloes are also affected with nasal catarrh, sometimes with oedema around the pharynx, and more rarely with an intense oedematous swelling of the tongue. These last symptoms led the author at first to suspect that he was dealing with haemorrhagic septicaemia but inoculation of pigeons proved negative whereas inoculation of rats always proved fatal. Acute cerebral symptoms may also be observed—the animals fall suddenly, rise, run as if affected with mania, fall again, and then remain lying on one side quite exhausted. In young and debilitated animals death follows, but full-grown and strong animals generally recover after these attacks of vertigo. The animals also frequently have a frightened appearance and hold their heads raised as if affected with opisthotonus. Circling movements were not observed. This commencing acute stage lasts about a week, and animals that have recovered from this stage generally show no apparent abnormalities. When they have not completely recovered they can, however, be proved to be infected by blood examination and inoculation. If the animal is well fed and kept indoors so that re-infection cannot take place then it completely recovers in three months, as can be verified by blood inoculation. If the animal is turned out to grass and worked and especially if the feeding is neglected then complete recovery is retarded. The animal may be re-infected in districts where surra is enzootic.

Animals which do not completely recover can thus be divided into two groups, viz., those which show no apparent ill-effects from surra and those in which the disease produces gradually increasing ill-effects; this division depends largely on the nature of the feeding. In a district in the Dutch East Indies well known to the author the buffaloes to a large extent harbour surra trypanosomes in their blood; in the western part of this district, where the grazing is good, the animals do not seem to suffer from the parasites as much as they do in the poorer eastern part. In all cases exacerbations may appear during the chronic course of the disease owing to bad feeding and a return of the acute symptoms may thus set in. The chances of recovery depend largely on the number and severity of these relapses. Exposure to inclement weather such as long continued rain and wind is also liable to set up a return of the acute form and mortality, especially among calves; this mortality rate is arrested whenever the weather conditions improve; this factor, however, is not of such great importance as the feeding.

Clinically affected buffaloes should not be allowed to work with healthy oxen; they are not only a danger to the horses which may also be employed at the work but, if the animals are badly fed and the previously healthy animals contract the acute form of the disease, the latter will suffer from a steadily increasing loss of condition, whereas the chronic carriers of trypanosomes may not apparently suffer in the same conditions.

In buffaloes suffering apparent ill-effects from chronic surra the symptoms are as follows:—the animals become thin, the hind-quarters insensitive and the gait more or less unsteady; they are of very little use for work, the coat becomes dull and has a scabby eczematous appearance; necrotic patches about a couple of inches in diameter are produced, mostly under the breast and abdomen and on the limbs, and slough off leaving ulcers which refuse to heal. The conjunctiva is pale, sometimes yellowish in colour. There is increased lachrymation and pregnant females show a great tendency to abort, and are then often affected with retention of the afterbirth and uterine prolapse. If the mothers carry their calves to full time the milk secretion is so small that the calf born dies subsequently of starvation. Pregnant animals also frequently fall down and are unable to get up, being affected with paresis of the hind quarters. If the animals are unable to get up within 24 hours cardiac disturbances set in and they die.

Diagnosis of the disease was carried out by the injection of 1 c.c. of defibrinated blood from the affected animals intramuscularly into rats.

Post-mortem examination of buffaloes dead from surra shows no characteristic lesions. A gelatinous exudate was sometimes found in the subcutaneous and intermuscular connective tissue. There was in some cases a large quantity of serous exudate in the chest cavity. The lymphatic glands were always swollen and infiltrated with serous fluid; sometimes they contained minute petechiae. Petechiae are also observed under the epicardium and in the myocardium. Lesions in connection with the gastro-intestinal tract are also observed where digestive disturbances were noticed during life.

With the object of checking the spread of and suppressing the disease the Government authorities of the Dutch East Indies provide regulations for the closing of surra-infected pastures and prohibiting the export of infected cattle into clean districts. The author notes, however, that surra is enzootic throughout large low-lying districts especially along the coast, but that it is much rarer in the mountainous regions. In the infected districts one can thus only apply palliative measures taking specially into account the fact that feeding plays a very considerable part; mortality is highest during the rainy season when the sugar-canes are sown and when there is no stubble to turn the buffaloes out on to; in the dry season when the animals can find food on the harvested fields surra causes only sporadic losses. On the other hand, in horses losses from surra occur mostly during the dry season when they suffer more severely from the bites of Tabanidae and when they are turned out with the oxen on to the stubble.

Macfie (J. W. Scott). **A Monomorphic Trypanosome of Man.**—*Report of the Accra Laboratory for the Year 1916.* pp. 60–66. With 1 coloured plate, 2 tables & 1 chart.

This article is of interest inasmuch as the trypanosome described showed a remarkable morphological resemblance to the commonly occurring trypanosome of domesticated animals in West Africa, viz., *T. vivax*. All the species and strains of trypanosomes that have hitherto been described as occurring naturally in the human blood have been of the polymorphic type, that is, they have shown long forms, shorter stumpy forms, and intermediate forms. In laboratory strains some of these organisms may in time become almost, if not quite, monomorphic, the long forms being very abundant and the stumpy forms rare or absent. Such strains must be regarded as abnormal, the result of a long series of inoculations into animals without the natural alternation in the insect host, and up to the present they have not been detected in nature.

The material used by Macfie in this study consisted of smears forwarded to him for examination from the blood of a native man at Tamale, Gold Coast. The history of the case suggested that the infection might have taken place about three weeks previously but apart from slight fever, which might not have been due to the trypanosomes, the patient had no symptoms of illness. After the first injection of atoxyl the trypanosomes disappeared and on subsequent examinations none could be detected. Two blood films were examined at different times while the parasites were discoverable in the blood and in both films a moderately heavy infection with trypanosomes was found. The living unstained organism was not examined by Macfie so that he was unable to give an account of its motility.

When fixed and stained the trypanosomes showed a characteristic appearance; all the individual elements were of similar shape and size. The shape of the body resembled that of *T. vivax* and showed an abrupt narrowing at the nucleus in front of which it tapered rapidly. The cytoplasm was clear showing an alveolar structure and granules

were rarely found. The posterior end was usually blunt and not prolonged beyond the blepharoplast. The nucleus was long, oval, often rather diffuse, and sometimes divided into two or more pieces. The blepharoplast was large, rounded, and terminal or very nearly so. The undulating membrane was poorly developed and scarcely visible. The flagellum was well-developed and ran in most cases along the body in a gently curved line without deep undulations. There was always a long free portion to the flagellum.

The length of the trypanosome was slightly less than that of *T. vivax* and the range of variation was relatively small. Of 200 parasites measured the longest was 24μ, the shortest 18μ, average 20·7μ; these lengths were similar in the case of both films. These measurements indicate clearly the monomorphic character of the parasite.

TABLE I.

Measurements of Length of the Monomorphic Trypanosome found in the Blood of a Native of the Gold Coast.

Materials.	Number measured.	Lengths in microns.							Average lengths in Microns.
		18	19	20	21	22	23	24	
First specimen .	100	3	14	25	37	17	3	1	20·6
Second specimen .	100	1	13	23	39	16	5	3	20·8
Totals . .	200	4	27	48	76	33	8	4	—
Percentages .	—	2·0	13·5	24·0	38·0	16·5	4·0	2·0	20·7

In the remainder of this article Macfie discusses matter of such high veterinary importance that it is reprinted in full as follows:—

"The length of *T. virax* varies from 18μ or 19μ to 28μ or 29μ. The measurements given by various observers working with different strains from widely separated countries all show a general similarity (see Table II). According to Bruce and his collaborators (1911), the Uganda strain of 1903 ranged from 20μ to 27μ in a series of 80 specimens measured, and the crest of the curve formed by plotting the lengths occurred at 24μ; the Uganda strain of 1909 showed a crest at 25μ and was on the whole similar excepting only for the occurrence of a few unusually small forms 16μ or 17μ in length; and the Cameroons strain of 1903, of which also only 80 individuals were measured, showed a crest at 23μ and a single unusually long trypanosome 31μ in length. The measurements of *T. vivax* made by Kinghorn and Yorke (1913), in Rhodesia ranged from 19μ to 29μ, and the curve reached its crest at 23μ; those made by me (1914) in Southern Nigeria ranged from 19μ to 28μ and showed the crest at 25μ; and a series from cattle on the Gold Coast (1915) ranged from 18μ to 29μ and their curve reached its highest point at 23μ. All these observations, therefore, agree in describing the length of *T. vivax* as having a restricted range varying from 18μ to 29μ, except in rare instances, and the curves formed by distributing the measurements show a decided peak at a length varying from 23μ to 25μ.

TABLE II.

The Distribution, by percentages, according to length of Various Strains of *Trypanosoma vivax*.

Strain.	Lengths in Microns.																
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average.
Uganda, 1903 (Pordage's ox). S. S. C.	—	—	—	—	2·5	3·7	22·5	22·5	30·0	15·0	2·5	1·3	—	—	—	—	23·3
Uganda, 1909. S. S. C.	0·6	1·1	—	1·1	2·2	1·7	6·1	11·6	19·5	24·4	22·2	6·7	1·7	1·1	—	—	24·4
Cameroons, 1903. S. S. C.	—	—	1·2	2·5	6·3	10·0	12·5	17·5	10·0	13·7	11·3	11·3	2·5	—	—	1·2	23·7
Rhodesia, 1912. Kinghorn and Yorke.* ..	—	—	—	1·5	2·5	8·5	16 0	22·5	18·0	14·5	9·5	4·5	2·0	0·5	—	—	23·63
Southern Nigeria, 1914. Maefie	—	—	—	1·0	4·0	4·0	13·0	19·0	23·0	27·0	4·0	3·0	2·0	—	—	—	23·74
Gold Coast, 1915. Maefie	—	—	1·0	2·0	5·0	12·0	18·0	29·0	18·0	9·0	3·0	2·0	—	1·0	—	—	22·64

* These authors do not record the actual figures, those given here are taken from their Chart.

"On comparing these measurements with those of the monomorphic trypanosome found in man it is evident that *T. vivax* is slightly the larger organism. In the human parasite the minimum length was about the same as that of *T. vivax*, but the longest individuals did not exceed 24μ, whereas *T. vivax* not infrequently measures 28μ or 29μ, and according to Bruce may even reach 31μ. The most common length—that is, the situation of the crest of the curve—was also different, viz., 21μ instead of 23μ to 25μ; and the average length, 20·7μ was less than that of any of the strains of *T. vivax*.

"The most detailed study of the length of *T. vivax* is, however, that of Blacklock (1912), which has not been referred to above on account of the difficulty of including his measurements in the table given. This author measured the length of 1,000 trypanosomes in goats at the Runcorn Research Laboratories, the strain being one isolated from a horse sent to Liverpool from the Gambia by Professor Todd. The longest of these trypanosomes measured 26·7μ, the shortest 15·5μ, and the average worked out at 21·7μ; 57·8 per cent. of the parasites measured between 20μ and 23μ. In the chart compiled by Blacklock from his measurements, the crest of the curve occurs at 22·5μ. To these measurements of *T. vivax* those of the monomorphic human trypanosome approximate more closely than they do to any of those previously referred to; and as in one of Blacklock's groups of 100 parasites the average length was 20·9μ, there cannot be said to be any appreciable difference between the lengths of the two organisms.

"Another trypanosome, *T. uniforme*, resembles in some respects the human parasite found in the Gold Coast. This organism was discovered by Bruce and his collaborators (1911) in Uganda in the blood of oxen, and was described as resembling *T. vivax* closely but differing from it 'in size, and perhaps to a slight extent in shape.' This trypanosome measured in length from 12μ to 19μ, and averaged 16μ; and the crest of the curve representing the distribution of 200 individuals in respect to length was at 16μ. *T. uniforme* was therefore a smaller organism than the monomorphic trypanosome described in the paper, although in general appearance it resembled it closely.

"The third trypanosome usually included in the same group as *T. vivax* is *T. caprae*, a parasite discovered by Kleine in goats in the neighbourhood of Lake Tanganyika. Kleine (1910) described this trypanosome as being larger than *T. brucei*, and stated that some forms had, others had not, a free portion to the flagellum. Bruce (1913) and his fellow investigators subsequently studied this organism in Nyasaland, and measured 500 individuals (taken from various animals) which ranged in length from 32μ to 18μ, averaged 25·5μ, and formed a curve similar to that of a monomorphic trypanosome with a peak at 25μ. They considered that '*T. caprae* differs from *T. vivax* in that it is heavier built and altogether has a larger and clumsier appearance,' and they denied the statement made by Kleine that some forms were without a free flagellum. So far as the actual measurements of length are concerned, there is no great difference between *T. vivax* and *T. caprae*, and it may be doubted if they could be separated by this character; it may be pointed out also that the difference in size between *T. vivax* and the monomorphic human trypanosome is greater than that between *T. vivax* and *T. caprae*. . . . Bruce noted as a curious fact that *T. uniforme* and *T. vivax* had not been met with by the Commission in Nyasaland, and suggested that this might be due 'to the absence of *Glossina palpalis*, which is their carrier, while *T. caprae* is carried by *G. morsitans*.' Kinghorn and Yorke however have shown that *T. vivax* is carried also by *G. morsitans*. It is not improbable, therefore, that *T. caprae* may be only a variety of *T. vivax*.

"The trypanosome found in the blood of this native of the Gold Coast appears to be intermediate between *T. vivax* and *T. uniforme* as regards its morphology. All three organisms have the same general form, but *T. vivax* is the longest, *T. uniforme* the shortest, and the Gold Coast trypanosome occupies an intermediate position nearer to *T. vivax*, however, tha to *T. uniforme*. . . .

"From the very small amount of materials available, and in the absence of any observations on the pathogenicity of the strain to animals,

it is impossible to decide the species of this trypanosome, but morphologically its similarity to *T. vivax* is very striking.

"Neither *T. uniforme* nor *T. caprae* has hitherto been identified in the Gold Coast, but *T. vivax* is an exceedingly common parasite of domestic animals in West Africa, and was found in no less than 76 per cent. of the hump-backed cattle examined by me at Accra (1914). It would therefore be a serious matter if this species were proved to be pathogenic to man. *T. vivax* is not pathogenic to monkeys, and has been regarded as harmless to man, an assumption which is strongly supported by the fact that a human infection has never yet been recorded, although the organism is widely distributed and very abundant in Africa. Blacklock and Yorke (1913), however, succeeded in rendering a strain of *T. vivax* pathogenic to rabbits, which are usually immune, and in the same way other refractory animals may become infected. It is possible, therefore, that occasionally, under abnormal conditions, this trypanosome might succeed in infecting man or might transiently appear in his blood, for it is transmitted by the bites of tsetse flies (*G. palpalis*, *G. morsitans*, and *G. tachinoides*) to which the natives of the Gold Coast are constantly exposed. It should be mentioned in this connection that Blacklock and Yorke examined the strain of *T. vivax* they used after it had been passed through six generations of rabbits, but that they failed to detect in it any morphological changes. In this case, then, no structural modifications appeared to accompany the alteration in pathogenicity which enabled the trypanosome to infect an unusual host.

"The description of this organism, incomplete though it is, is put on record in order to draw the attention of future workers in the Gold Coast to the fact that there is in West Africa a species of monomorphic trypanosome capable of infecting man."

BRUGGEMAN (J. P. I.). **Anaplasmose bij Buffels (voorloopige mededeeling).** [Anaplasmosis in Buffaloes. Preliminary Communication.] —*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 2. pp. 175–181.

This note deals with a serious outbreak of disease which first appeared among buffaloes in the district around Rembang on the northern coast of Java, Dutch East Indies. The mortality rose to 28 out of 200 in the first affected centre. Blood smears taken from the animals first affected showed an excessive number of trypanosomes and as the symptoms shown consisted in an excessive flow of saliva, swelling of the limbs, anaemia, varying temperature and emaciation the disease was first diagnosed as surra. However, from time to time smears taken from animals showing manifest clinical symptoms showed no trypanosomes; hence the presence of another disease was suspected, especially on account of the high mortality. Besides, it is stated by this author that surra always runs a chronic and favourable course in buffaloes. Eruptions and desquamation of the skin together with severe diarrhoea were observed in addition in the affected animals.

The disease was later found to have become widespread in other districts and examination of blood preparations from these places always gave negative results as to the presence of trypanosomes; inoculation of the small experimental animals likewise gave negative results. A more careful examination of blood smears after staining with Giemsa and Leishman was then resorted to and these showed the presence of red corpuscles in good condition showing especially at their margins a number of darkly staining points. In rare cases these points were situated towards the centres of the corpuscles. The

disease was thus diagnosed as being due to *Anaplasma marginale*. The blood of affected animals, especially when the disease was of several days standing, invariably presented this appearance. Towards death the bodies became greater in number and at the same time peculiar degenerative appearances were seen in the interior of the corpuscles in the form of rounded or crescentic colourless spots or cavities which appeared as if they had previously enclosed the parasites; poikilocytosis and anisocytosis and other anaemic changes were then seen.

According to the author the disease in Java could be recognised by the following symptoms:—

(1) A profuse green watery diarrhoea containing no blood or mucus.

(2) A skin eruption which gives the animal a mildewed appearance or as if it was covered with fine wire netting. The crusts originate with the formation of small vesicles especially on the back, loins, and croup. These burst and form a white scurf which on falling off leaves behind an unpigmented patch of skin. About the base of the ears especially long furrows oozing blood may be thus formed. This mildewed appearance generally begins two or three days before the onset of severe diarrhoea and the refusal of food.

(3) Sunken eyes with a watery, sometimes a little muco-purulent, discharge; always very marked photophobia with blinking of the eyes.

(4) Temperature as a rule between 100·4 F. (38° C.) and 101·4° F. (38·7° C.); the muzzle is not dry.

The disease was never observed affecting cattle. No ticks were found in spite of a careful search. Exceptionally a few buffaloes recovered but the great majority died in from two to five days after the onset of diarrhoea with marked emaciation. It is stated that this mortality due to the *marginale* agrees with the finding of THEILER that this variety produces a virulent form of the disease while the *centrale* sets up a milder form.

The bodies found within the corpuscles were distinguishable from degenerative formations (*Randkörnchen*) inasmuch as the latter stained of an azure-red colour; no piroplasms were discoverable.

A longer report is promised when the author has been able to consult the literature and finish a number of experiments he has in hand concerning the disease.

PRICOLO (Antonio). **Classificazione della piroplasmosi tunisina.** [Classification of Tunisian Piroplasmoses.]—Reprint extracted from *Moderno Zooiatro* 1915. 2 pp.

In this note Pricolo reproduces some correspondence which took place between him and THEILER regarding some preparations sent to the latter for examination. "The parasites found in the smears were indistinguishable from those found in the blood of cattle affected with East Coast fever in South Africa and in particular the presence of Koch's blue bodies left no room for doubt but that the organism was *Piroplasma parvum*."

The blood from affected animals failed to infect susceptible animals by direct inoculation and the progeny of ticks fed on infected cattle

were found to be innocuous. Sardinian cattle were found to show visible symptoms within about 20 days after contact with infected Tunisian cattle. Imported Italian cattle often revealed the presence of *Piroplasma bovis* in their blood.

STEFKO (W.). **Piroplasmose et Anaplasmose en Turquie (1916).** [Piroplasmosis and Anaplasmosis in Turkey. 1916.]—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 723–724.

Several cases of the above diseases were observed in oxen imported from Russia into Turkey (Trebizond, Platana, and Rizeh, etc.) during the summer of 1916. The mortality produced was very high (80–90 per cent.). The parasites found in smears from the spleen belonged to *Piroplasma bigeminum, annulatum* and to *Anaplasma centrale*.

Infection with both parasites was very common. The intermediate host was *Boophilus annulatus*. The eggs of this tick were infected to a very large extent with piroplasms. *Ixodes corniger* Kol. and *Rhipicephalus simus* Koch were not so commonly found in this region.

FRANÇA (Carlos). **Sur la classification des hémosporidies.** [Classification of the Haemosporidia.] — Reprint from *Jl. de Sciências Matemáticas, Fisicas e Naturais.* Series 3. No. 1. 41 pp. With 29 text figs. & 1 table. 1917. Lisbon : Imprensa Nacional.

"In the classification of *Haemocytozoa* or *Haemosporidia* the greatest confusion still exists and it is thus desirable to revise their classification. The confusion arising in connection with the systematic position of these protozoa is undoubtedly due to the very strict parasitism of these cytozoa. This permanent parasitism impresses on the different forms a particular aspect which renders a systematic classification difficult; but at the same time the peculiarities of this parasitism tends to justify the adoption of the order *Haemosporidia* to which Mesnil, in a recent work, denies any taxonomic value.

"In our opinion one should consider as belonging to the *Haemosporidia* only those coccidiform protozoa adapted to intra-corpuscular life.

"The *Haemosporidia* constitute one of the sub-orders of *Sporozoa* and may be characterised thus :—

> "Protozoa living in the blood corpuscles, either in the red corpuscles or in the leucocytes; possessing a schizogonic phase in the body of the vertebrate and a sporogonic phase in the invertebrate. The invertebrate in which is passed the sexual cycle of the protozoon and which represents its primitive host is the transmitting agent of these forms.

"The sub-order *Haemosporidia* constitutes with the sub-order *Coccidia*, the order *Coccidiomorpha*.

"The French parasitologist Mesnil, in the work above referred to, states: 'França speaks of the order of *Haemosporidia*. He means to convey, no doubt, by this term the re-union of three families—*Plasmodiidae* (or *Haemamoebidae*), *Haemogregarinidae*, and *Piroplasmidae*. I believe that in the actual state of our knowledge, such a grouping is no longer possible.'

"Mesnil bases this statement on the fact that the *Haemosporidia* present sexual phenomena which vary markedly according to the families considered: of the type *Adelea* (*Haemogregarina*), of the type *Eimeria* (*Plasmodidae*), or of a type intermediate between these two (*Piroplasmidae*), and also inasmuch as they constitute 'a heterogeneous collection which have no characters in common except the general characters of the Coccidia.'

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"We cannot follow Professor Mesnil in these conclusions. We believe simply that one has to recognise common ancestral forms in the origin of *Coccidia* and *Haemosporidia* and that this explains the analogy and even the identity existing between the multiplication phenomena of the forms belonging to these two sub-orders.

"The *Haemosporidia* must, in addition, represent the most recent *Sporozoa*; several of these forms are still tentatively adapting themselves to the vertebrate body, and this is manifested by their pathogenicity, which always signifies a lack of harmony, the result of incomplete adaptation.

"The common ancestors and identical conditions of life (intracellular habitat) impresses on the two sub-orders of *Coccidiomorpha* a certain number of common characters.

"We thus accept the sub-order *Haemosporidia*, which in the classification of protozoa should have the following place :—

Class.	Sub-class.	Order.	Sub-order.
"Sporozoa	Telosporidia	Gregarinida	
		Coccidiomorpha	Coccidia
			Haemosporidia
	Neosporidia		

"The sub-order *Haemosporidia* comprises four families :—

"1. *Haemogregarinidae.*
"2. *Plasmodidae.*
"3. *Piroplasmidae.*
"4. *Toroplasmidae.*"

The bases for the classification of the haemosporidia into four families are indicated in the accompanying table opposite.

1. Fam. *Haemogregarinidae* Neveu Lemaire, 1901.

(a) Genus *Haemogregarina* Danilewsky, 1885. (Syn. : *Drepanidium* Lankester, 1882 pro parte; *Karyolysus* Labbé, 1894; *Danilewskya* Labbé, 1894.)

"Vermicular non-pigmented haematozoa living within the blood corpuscles. Schizogony within cysts in the internal organs,—either within the corpuscles (Haemogregarines of tortoises, snakes, and fishes) or outside the corpuscles (Haemogregarines of mammals and lizards)."

A list of 225 species together with their hosts and geographical distribution is given.

(b) Genus *Hepatozoon* Miller, 1908. (Syn. : *Leucocytozoon* Danilewsky, 1889, pro parte; *Leucocytogregarina* Porter, 1909.)

"Vermicular haematozoa without pigment and living within leucocytes. Schizogony inside cysts within the internal organs, sometimes in the cells of the organ.

"All forms hitherto described have been found in mammals."

A list of 22 species is given; the most important one appears to be *H. canis* Bentley and James, 1905, found in the dog in India, Australasia, and Africa.

2. Fam. *Haemamoebidae* Ross, 1889. (Syn. : *Plasmodiidae* Lühe, 1906.)

(a) Genus *Plasmodium* Marchiafava and Celli, 1885. (Syn. : *Polychromophilus* Dionisi, 1898.)

"Pigmented haemamoebidae in which the gametocytes are identical with the schizonts. Schizogony in the peripheral blood."

					Genera.	Families.
Haemosporidia inhabiting	the blood	Non-pigmented.	Without flagelliform microgametes.	Schizogony in the interior of cysts in the internal organs.	*Haemogregarina* Danilewsky, 1885. *Hepatozoon* Miller, 1908.	*Haemogregarinidae* Neveu-Lemaire, 1901.
				Schizogony within the corpuscles of the circulating blood or in the interior of the internal organs.	*Piroplasma* Patton, 1895. *Smithia* França, 1909. *Nuttallia* França, 1909. *Theileria* Bettencourt and Borges, 1907. *Paraplasma* Seidelin, 1912. *Achromaticus* Dionisi, 1900. *Rangelia* Carini and Maciel, 1914. *Rossiella* Nuttall, 1910. *Elleipsisoma* França, 1910.	*Piroplasmidae* França, 1909.
			Flagelliform microgametes.	Schizogony in the internal organs.	*Leucocytozoon* Ziemann, 1898.	
		Pigmented	Flagelliform microgametes.	Schizogony in the corpuscles in the circulation or in the internal organs	*Plasmodium* Marchiafava and Celli, 1885. *Laverania* Grassi and Feletti, 1889. *Haemoproteus* Kruse, 1890. *Proteosoma* Labbé, 1893. *Haemocystidium* Castellani and Willey, 1904.	*Haemamoebidae* Ross, 1899.
	the organs	Non-pigmented	Without flagelliform microgametes.	Schizogony in the interior of cells.	*Toxoplasma* Nicolle and Manceaux, 1908.	*Toxoplasmidae* n.f.

A list of 28 species is given, including the causal agents of human tertian and quartan malarial fever, and *P. canis* Castellani and Chalmers, 1908, found in the dog in Ceylon.

(b) Genus *Laverania* Grassi and Felletti, 1889.

"Pigmented haemamoebidae in which the gametocytes (crescentic-shaped bodies) are different in shape from that of the schizonts. Schizogony within the blood corpuscles in the internal organs."

This genus comprises only one species, viz., *L. malariae* (or *Plasmodium falciparum*), the causal agent of tropical malarial fever in man.

(c) Genus *Haemoproteus* Kruse, 1890 (= *Halteridium* Labbé, 1894).

"Pigmented amoeboid dumb-bell shaped Haemamoebidae which surround but do not displace the nucleus of the corpuscle. Schizogony in the internal organs. Exceptionally, schizogony in the circulating blood. Two groups of merozoites at each pole of the dumb-bell."

A list of 18 species found in birds, including the well-known Haemoproteus of the pigeon, is given, and also a long list of various species of birds in which the parasites have been found in different parts of the world; three species are known to occur in tortoises and snakes.

(d) Genus *Proteosoma* Labbé, 1893.

"Pigmented Haemamoebidae, generally displacing the nucleus of the invaded corpuscle. Schizogony in the circulating blood. Merozoites arranged around a residual body."

Twelve species are enumerated, including the Proteosoma of the common sparrow.

(e) Genus *Haemocystidium* Castellani and Willey, 1904.

"Pigmented Haemamoebidae which in their adult stage are oval or rounded in shape (never amoeboid), with a perfectly regular contour, vacuolated cytoplasm, and an almost invisible nucleus. Very marked sexual dimorphism. The nucleus of the corpuscle is at a very early stage pushed towards one of the extremities of the corpuscle. Schizogony in the circulating blood by means of binary or quaternary division."

Three species of no great importance are mentioned.

(f) Genus *Leucocytozoon* Ziemann, 1894.

"Non-pigmented Haemamoebidae living in the corpuscles in which they produce marked changes in appearance. Very distinct sexual dualism. Gametes rounded (type B), or oval (type A), producing in the latter case a peculiar deformity of the corpuscles, viz. two tapering polar expansions. Schizonts in the internal organs where schizogony takes place. Flagelliform microgametes. Large, elongated, non-pigmented ookinete."

A large number of species of both types have been described in birds and 42 species are enumerated in this paper, including *L. anatis* Wickware, 1915 (type A), found in the duck in Canada.

Fam. *Piroplasmidae* Franca, 1909.

(a) Genus *Piroplasma* Patton, 1895 (= *Haematococcus* Babes, 1888; *Pirosoma* Smith and Kilborne, 1893; *Babesia* Starcovici, 1893; *Apiosoma* Wandolleck, 1895).

"Haematozoa showing during one of their stages a pear-shaped form and arranged in pairs within the same corpuscle. Division takes place by a process of gemmation."

This genus contains some of the most important Haematozoa of the domesticated animals. Eight species are given, of which the following are the more important :—

Species.	Host.	Intermediate host.	Distribution.
P. bovis Babes, 1888.	Bovines.	*Boophilus annulatus, australis* and *decoloratus.*	North and South America, Australia, Asia and Africa.
Synonym : *P. bigemina* Smith and Kilborne, 1893.	Bovines.		America.
P. divergens McFadyean & Stockman.	Bovines.	*Ixodes ricinus.*	Europe.* (In Portugal the disease caused by this species is called *ferrujao.*)
P. ovis Starcovici, 1893.	Sheep.	*Rhipicephalus bursa.*	Italy, Turkey, Roumania and Transcaucasus.
P. canis Piano & Galli-Valerio, 1895.	Dog.	*Rhipicephalus sanguineus, Haemaphysalis leachi.*	The whole world.
P. caballi Nuttall, 1910.	Horse.	*Boophilus annulatus, Dermacentor reticulatus.*	Russia, Roumania, Transcaucasus, Siberia.

(b) Genus *Smithia* França, 1909.

"Haematozoa showing during one of their stages a pear-shaped form. The majority of the pear-shaped parasites occupy the whole diameter of the corpuscle and are not arranged in pairs. Multiplication by division into four (in the shape of a cross)."

Two unimportant species are at present known.

(c) Genus *Nuttallia* França, 1909.

"Oval, more rarely pear-shaped haematozoa. Multiplication forms in the shape of a cross. The elements composing the cross possess a relatively abundant protoplasm. No rod-shaped elements."

Eight species are enumerated, one of which, viz., *N.* [illegible] Laveran, 1899, is pathogenic for the horse and is found in Italy, [illegible], Transcaucasus, India, Annam, Brazil; intermediate host, *Rhipicephalus bursa.* "The disease caused by this piroplasm has been called Nuttalliasis, and is more severe than that due to *P. caballi* (Piano)."

(d) Genus *Theileria* Bettencourt, Franca, & Borges, 19[illegible].

"Rod-shaped haematozoa which on division give rise to elements taking the form of a cross. The elements of the cross are very small, rounded, and almost exclusively composed of chromatin."

"This genus contains pathogenic species, some of which are of great economic importance on account of the mortality they produce among cattle."

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* From this table the reader might be led to believe that *P. divergens* was the only piroplasm found affecting cattle in Europe. This notion is, however, called to McFadyean and Stockman's original article in which they state :—

"We have also satisfied ourselves that the piroplasma bigeminum is a cause—we think probably the common cause—of redwater in Great Britain, and for purposes of comparison we give here (fig. 1 and fig. 2) illustrations respectively of an English strain of the piroplasma bigeminum and of the piroplasm which we hold to belong to a different species" (*Jl. Comp. Path. and Ther.*, 1911. Dec. Vol. 24. Part 4. p. 340).—Ed.

Of the 10 species enumerated the following appear to be the more important :—

Species.	Host.	Intermediate host.	Distribution.
Theileria annulata Dschunkowsky, 1904.	Bovines.		Russia.
T. parva Theiler, 1904.	Bovines.	*Rhipicephalus appendiculatus, R. simus, R. evertsi, R. nitens, R. capensis.*	Africa (producing the diseases known as East Coast Fever, Rhodesian "red-water," *Amakebe* in Uganda, Mediterranean Coast Fever (Carpano).
T. mutans Theiler, 1907.	Bovines.	*R. simus, R. evertsi.*	Africa (at one time alleged to be the cause of gall-sickness).
T. dama Bettencourt, França and Borges, 1907.	*Cervus dama.*		Portugal.
T. hippotraqi Todd & Wolbach, 1912.	*Hippotragus equinus.*		Africa.
T. stordii França, 1912.	*Gazella grantii.*		Abyssinia.
T. ovis Rodhain, 1916.	Sheep.		Africa.

(e) Genus *Paraplasma* Seidelin, 1912.

" Rod-shaped elements as in the case of *Theileria*. Ring-shaped forms as in the case of *Plasmodia*. Schizogony in the capillaries of the internal organs especially in the kidneys."

One species has been described, viz., *Paraplasma flavigenum* Seidelin, the alleged causal agent of yellow fever in man (intermediate host *Stegomyia calopus*).

(f) Genus *Achromaticus* Dionisi, 1900.

" Sickle-shaped, pear-shaped, or rounded elements. Schizogony within the red corpuscles usually giving rise to numerous merozoites. Very elongated forms may occupy the whole diameter of the corpuscle."

This genus contains one species found in different species of bats, and another of importance—*A. gibsoni* Patton, 1910, inasmuch as it has been alleged to be pathogenic for sporting dogs (*Canis aureus*) in Madras.

(f) Genus *Rangelia* Carini and Maciel, 1914.

" Rounded, oval, or pear-shaped forms arranged most frequently in pairs. Schizogony in the protoplasm of the connective tissue and endothelial cells of the internal organs producing a very large number (30 to 100) of merozoites."

One species only is known, viz., *Rangelia vitalli* Rangel Pestana, 1910, a disease-producing organism of dogs in Brazil. The disease caused by this protozoon is known as *Nambiuvù*.

(g) Genus *Rossiella* Nuttall, 1910.

" Very large, usually rounded haematozoa. Rounded nucleus. Schizogony in the interior of the corpuscles by means of binary division, which may be repeated a certain number of times, thus producing a rather variable number of large merozoites."

One species only is known, viz., *Rossiella rossi*, Nuttall, 1910, parasitic in *Canis adustus* (Africa).

(h) Genus *Elleipsisoma* França, 1910.

"Elliptical or oval non-pigmented forms living within the corpuscles which become deformed and deprived of haemoglobin. Relatively large nucleus usually placed close up to one of the margins of the haematozoon. Schizogony and binary division in the lung."

This genus contains one species found in moles in various countries in Europe.

4. Fam. *Toxoplasmidae* n.f.

This family contains one genus *Toxoplasma* Nicolle and Manceaux, 1908.

"Oval or kidney-shaped protozoa which reproduce by longitudinal division or by multiple division in the interior of the invaded cells. Found in the mononuclears and polynuclears in the spleen and other organs, and, exceptionally, in the blood."

This genus comprises already thirty known species some of which are extremely pathogenic, the latter including *Toxoplasma cuniculi* Splendore, 1909, pathogenic for the rabbit (*Oryctolagus cuniculus*) in Brazil and *T. canis* Mello, 1910, pathogenic for the dog in Italy, Germany and Brazil. Another species *T. pyrogenes* Castellani, 1914, has been incriminated as the cause of chronic fever in man in India and the Black Sea Coast.

"There are found among the Haemosporidia certain genera whose systematic position has not yet been determined on account of our lack of knowledge concerning certain peculiarities in their biology.

"The genera *Immanoplasma, Toddia, Microsoma,* and *Pirhemocyton* belong to this category, but they, however, possess certain characters in common which enable one to group them together."

These genera comprise only a few species of no economic importance and thus the description of their characteristics is omitted from this extract.

There are still a number of Haematozoa which on account of their nuclear dimorphism seem to be closely connected with the flagellates. This has been proved in the case of Leishmania and thus these organisms are excluded from the Haemosporidia. The same has not yet been shown in the case of the genera Dactylosoma, Nicollia, and Endotrypanum, and thus although França gives the characters by means of which they can be identified he is convinced that some of them must later be removed from the order Haemosporidia.

DISEASES DUE TO METAZOAN PARASITES.

WIRTH (D.). **Filariosen bei einheimischen Pferden (Vierte Mitteilung).** [Filariasis in Native (Hungarian) Horses, Fourth Report.]—*Zeitschr. f. Infektionskr. parasit. Krankheit. u. Hyg. d. Haustiere.* 1917. June. Vol. 18. Nos. 4 & 5. pp. 380–413. With 4 plates comprising 10 figs.

In reports published 1911–1913 the author dealt with the question of the presence of microfilariae in the blood of Hungarian horses, and principally with the clinical symptoms observed. The present paper is concerned with the morphology and biology of the parasites and their further development into what is considered as the adult stage.

The affected animal used for these studies was a four-year old horse bred at a military stud where numerous cases of filariasis had occurred

especially during the preceding summer. The horse was kept under clinical observation for four months (May-August, 1914); during this period the temperature was slightly subnormal, breathing 10 to 16, and pulse 30 to 40 per minute, heart-beats irregular, intermittent after every four beats, and heart action very violent on slight exertion; the appetite was somewhat depraved but otherwise the horse ate well and its general condition was good. The urine was normal and no microfilariae were found in the sediment. From 1 to 3 microfilariae were found in each drop of blood. Blood examination gave the following figures:—haemoglobin, 97·5° (estimated by SAHLI's method); red corpuscles, 11,158,000; white corpuscles, 13,376; proportion between red and white corpuscles, 1 : 804; lymphocytes, 30·8 per cent.; polynuclear leucocytes, 60 per cent.; eosinophiles, 5·2 per cent. (4–8·3 per cent.); mononuclears and transition forms 4 per cent.

Clinical symptoms of microfilariasis in the horse.—The following is a summary of the author's previous reports. Filariasis appears generally during the hotter part of the year. Hitherto young animals (foals) more especially have been found affected; the oldest was eight years old. The body temperature was usually subnormal or sometimes very slightly above normal. The affected animals show general lassitude and a somewhat diminished appetite which is occasionally temporarily increased. The most noticeable symptom is the rapid exhaustion of the animal at work, thus rendering riding horses useless. It is not decided whether the irregularity in the action of the heart shown in some animals is a characteristic symptom. The sudden collapse of the animal especially in the stable is a further symptom. MANDEL was of opinion that the nematode worm found in the eyeball of horses affected with moon-blindness was probably connected with filariasis. None of the author's cases was simultaneously affected with moon-blindness and in a military stud where moon-blindness was not uncommon no microfilariae were found in the horses so affected. As a rule the disease was found to last from three months up to a year. The number of parasites in a drop of blood was found usually to vary between one and six, but sometimes the number might drop down to one in every five or ten drops of blood and occasionally single specimens only could be found after prolonged searching. In all cases, however, marked eosinophilia was discoverable; whilst in normal horses the proportion of eosinophiles is about 3 per cent. in filariasis they may increase up to over 8 per cent. An appreciable leucocytosis was not observed and the number of red corpuscles and the haemoglobin content were approximately normal. Leucocytosis and anaemia on the other hand are common in canine filariasis. The percentage of lymphocytes was with one exception high, thus corresponding with YAKIMOFF'S observations regarding filariasis in Turkestan. Microfilariae may be present in the blood of horses showing no apparent symptoms of disease.

The author holds that the microfilariae were responsible for the clinical symptoms inasmuch as (1) no other causes were discoverable, (2) where observation was continued over a long-enough period it was found that a complete recovery set in after the disappearance of the microfilariae from the blood, (3) other authors describe similar conditions in man as well as other animals caused by microfilariae. In

those cases where microfilariae are found in apparently healthy horses they are very few in number and not always present.

The disease generally runs a favourable course but recovery generally takes a long time,—several weeks or months. In the author's cases recovery seemed to be complete, at least no recurrence was observed.

The author is of opinion that no drugs are beneficial in the treatment of affected animals, recovery taking place naturally in two to four months. Atoxyl administered in from 1 to 2 gramme doses subcutaneously gave negative results.

Technique of examination for microfilariae.—Blood for testing is best taken by puncturing the facial vein; the necessary amount of blood may also sometimes be obtained by incising the mucous membrane of the lips; large quantities if needed are taken from the jugular vein. Thick smears are usually necessary and the cover glass used should be somewhat larger than those ordinarily employed.

The simplest method of detecting the parasites is by the examination of fresh preparations between slide and cover glass under a low power of the microscope; in certain cases an oil-immersion lens is required combined with a dark ground illumination.

Another good method for detecting and also for counting the parasites consists in spreading a large drop of blood on a slide, allowing to dry and then getting rid of the haemoglobin by placing in distilled water. The thin grey film remaining is fixed in alcohol for a few minutes, washed and stained with haematoxylin. Before examination the smears are covered with a layer of cedar wood oil in order to increase their transparency.

The cellular structure is best made out by employing Looss's method. The cover glass is smeared with a thick layer of blood and placed wet side downwards for two or three minutes in 70 per cent. alcohol kept at 60° C. The smears may be preserved in 70 per cent. alcohol for a long time. Before staining, the preparations are put through increasing concentrations of alcohol. They are then stained with haematoxylin, dehydrated in alcohol, clarified in oil of bergamot, and mounted in Canada balsam.

Intra-vitam staining with a solution of azur II. in distilled water (1 : 3,000) is suitable for the study of the internal organs of the parasite. A drop of blood and a drop of the staining solution are mixed together on a slide and covered with a cover-glass. The microfilariae remain alive for some time but take on the colour. All these methods are surpassed by the following processes lately introduced by Fülleborn, viz.:—

(*a*) Azur-eosin stain. The freshly dried, not too thick, smears on cover glasses are stained for 1½–3 hours in a solution composed of 4 c.c. of alkaline 1 per cent. azur II. solution + 100 c.c. of 0·9 per cent. salt solution. The preparations are then placed in a 1 per cent. solution of eosin in a 0·9 per cent. salt solution for 10 minutes. The preparations must only be allowed to remain in the first solution until the bodies of the parasites acquire a light blue tinge.

(*b*) Carbol-methyl-green-pyronin stain. The freshly dried smears are placed for one to two minutes into 0·9 per cent. salt solution and then for half-an-hour or longer in carbol-methyl-green-pyronin (Pappenheim-Unna) to which one-tenth of its volume of 0·9 per cent. salt solution has been added. The preparations are then differentiated

in 10 per cent. alcohol for 10 seconds, in 30 per cent. for 10 seconds, and in absolute for 20–30 seconds. They are then clarified in oil of bergamot and mounted in Canada balsam.

For counting the number of microfilariae in blood 20 cmm. is taken as a standard measure in the case of human beings, but, as the number of parasites is not generally so numerous in horses, the author used a larger quantity (100 cmm.). This quantity was sucked up into a pipette, placed on a slide and spread into an even layer by means of a knife. The preparations were dried and stained according to the method used for counting described above.

A method of concentrating the parasites consists in taking a moderately large quantity of blood from the jugular vein, defibrinating and centrifuging at a high speed for two hours or more. The microfilariae are found in the layer between the serum and the red corpuscles.

The measurements were taken by means of an ocular micrometer and an oil immersion lens. They were only approximately accurate in the case of living specimens.

The diagnosis of the parasites is made by examining fresh preparations or stained smears freed from haemoglobin. If numerous, parasites may be detected in the first smear examined but otherwise a large number (at least 10) must be repeatedly searched. In such cases the concentration process should be used.

Morphology and biology of the microfilariae.—In fresh preparations the parasite is seen as an elongated white small worm about the width of a red corpuscle and about 50 times as long. It executes very lively, snake-like movements between the corpuscles, sometimes becoming coiled into a spiral-like shape and sometimes straightening itself out. It is often difficult to keep within the field of the microscope even under a low power. The measurements can only be determined during a period of rest; the length is about 250 to 290 microns and the width 5 to 7 microns; dead parasites are always shorter owing to shrinkage. The anterior extremity is blunted and the posterior drawn out and pointed in appearance. The body is of uniform width along the part extending between the anterior tenth and the end of the third quarter of its length. The posterior quarter tapers to a fine thread-like extremity. Under a high magnification and with the use of dark ground illumination the granular body substance is seen to be surrounded by a narrow lighter zone which is the envelope representing, according to some authors, the covering of the embryo. No adhesion to the slide as seen in many other microfilariae was observed. In dried preparations freed from haemoglobin the microfilaria is seen under a low power as a thread-like coiled-up body staining dark blue; in some cases the envelope is seen to protrude in front and behind as a delicate faintly stained shred. The coiling of the body presents no special characteristics.

Dry fixation and staining with Giemsa is not suitable for showing the structure of the organism owing to shrinkage. This is better seen by the use of Looss's method; the body then generally takes up a straightened out appearance and the dark blue body is seen to be surrounded with a sheath which is easily recognisable owing to its protruding in front and behind. The body is found to consist of a large number of regularly arranged granules which are interrupted in three distinct places by transparent areas free from granules.

The stained organism is found to be shrunk so that it now measures 150 to 240 microns, the sheath protruding anteriorly by about 6 to 16 microns and posteriorly by about 20 to 40 microns. Shrinkage occurs after the employment of every method, especially after dry fixation, but least of all in FÜLLEBORN's method. According to RODENWALDT the dark granular appearance of the body is an artefact produced owing to the strong staining affinities of the cells lining the intestinal tract thus masking the appearance of the other organs. In this granular mass of deeply stained intestinal cells only three gaps are plainly visible which represent the nervous centre or nerve ring (N.), the excretory pore (Ep.) and the genital or anal pore (Gp.).

The nerve ring is situated towards the anterior part of the body and runs across it obliquely in the form of small stripes. The excretory pore lays at the junction of the anterior and middle third of the body, and the genital pore in the posterior third of the body; the excretory pore is larger than the genital pore; each takes up about half the width of the organism. In order to study the finer details it is advisable to adopt intra-vitam staining or FÜLLEBORN's method of staining and examine a considerable number of specimens—which is difficult on account of their sparsity in horses—as the complete details cannot as a rule be observed in the case of a single specimen.

Excretory organ.—Under an oil immersion lens one may observe that the stain is taken on comparatively deeply at the junction of the anterior and middle third of the body and spreads out in a backward direction. At this point is found an elongated oval, clear, vesicular-looking gap opening outwards, viz., the excretory pore. A short distance behind the pore is noticed the excretory cell (Ez.) lying in the middle line of the body and about half the width of the worm. It is of an elongated oval shape and possesses a lightly staining cytoplasm with a dark blue oval nucleus lying in its middle. The cell is surrounded with a small dark blue area which is connected with the pore by a thin stripe.

Genital organ.—The second distinctly stained place is the genital or anal pore according to RODENWALDT, but LOOSS, FÜLLEBORN, and SAISAWAS doubt the correctness of this statement. Like the excretory pore the genital pore here appears as a gap of variable size and form opening outwards. At a distance of several worm breadths towards the head lies a large cell, the principal genital cell (G_1) and at some distance between this and the genital pore lie closely together three smaller cells (G_2, G_3, G_4) applied closely to the side of the wall opposite the pore. All these cells are surrounded by a darkly stained area.

Besides the cells of the excretory and genital pores may be seen in deeply stained specimens a few very lightly staining spindle-shaped cells distributed along the whole wall of the body, but especially near the excretory pore. According to RODENWALDT these are known as the matrix cells of the sub-cuticula.

In many cases two indistinct red specks (M) can be seen near the buccal end of the parasite when stained by FÜLLEBORN's method. These must be analogous to the red mouth structures described in some species of microfilariae.

Internal body.—Between the excretory and genital organs is sometimes seen an elongated structure about 50 microns long with a wavy outline and a little narrower than the body of the microfilaria.

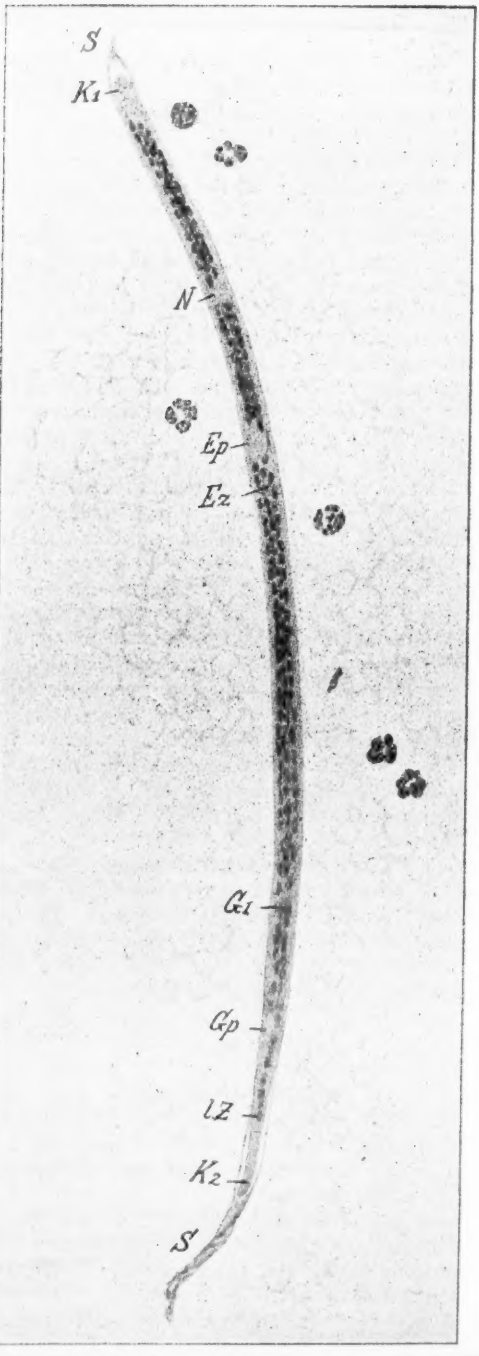

Fig. 3.—Microfilaria stained according to Looss's method. Very highly magnified. S = sheath (folded); K_1 = anterior extremity; K_2 = posterior extremity; N = nerve ring; Ep = excretory pore; Ez = excretory cell; G_1 = principal genital cell; Gp = genital pore; lZ = terminal stainable cell.

Fig. 4.—Microfilaria stained according to Fülleborn's azur-eosin method. Highly magnified. S = sheath; K = characteristic head structures; M = red mouth structures; N = nerve ring. Ep and Ez = excretory pore and cell; G_1 = principal genital cell; G_2, G_3, G_4 = genital cells; Gp = genital pore; eos. L = eosinophile leucocyte.

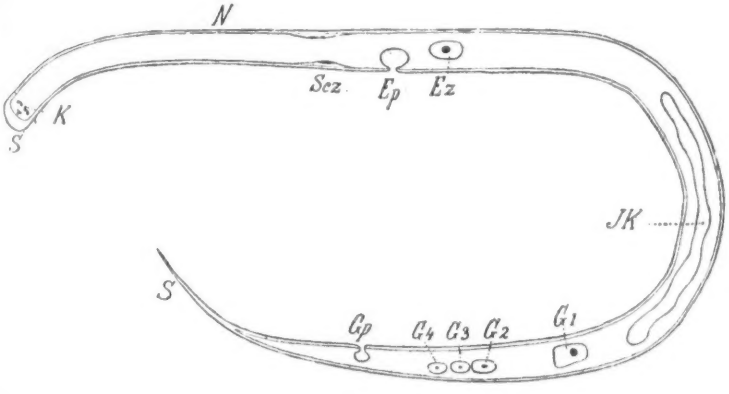

Fig. 7

Fig. 7.—Schematic structure of the microfilaria. S = sheath; N = situation of nerve ring; Scz = matrix cells of the subcuticula; K = characteristic head structures; Ep and Ez = excretory pore and cell; JK = internal body; G_1 = principal genital cell; G_2, G_3, G_4 = genital cells; Gp = genital pore.

It is rendered visible owing to its being less transparent than the body of the worm but its form and position are found to be continually changing. The significance of this body is not known. A short tube which is probably the gullet may sometimes be recognised.

Buccal structure.—In a fresh preparation under a high magnification one may observe at the anterior end of the parasite to the right and left of the middle line a clear refractile rod-shaped speck each apparently connected with the other. Below these two small specks may be seen still more minute but similar-looking structures. In the case of dead specimens in a preparation examined in the fresh state or stained by FÜLLEBORN'S method a few will show the following structure :—The sheath overlaps the head to a greater or less extent and at the buccal end of the worm may be seen to the right and left two small dumb-bell shaped structures running transversely. Between these may be seen a third speck of similar shape. The function of these bodies is not known.

Retraction of the body within the sheath.—This phenomenon, described by various authors in the case of other microfilariae (e.g., *M. bancrofti*), was rarely seen by the author. Close observation of living specimens under a high magnification showed that the phenomenon was in reality an artefact due to a lateral observation of the extremity during a turning movement of the parasite. The author considers that this is probably the explanation of such appearance described by authors in the case of microfilariae especially of the human subject.

Differential characteristics. — Various characters used for the recognition of microfilariae have already been dealt with, viz., (1) the presence or absence of a sheath, (2) length and breadth, (3) the characteristic position in air dried preparations freed from haemoglobin, and (4) the structure of the excretory and genital organs. The fifth important point, viz., the position of the separate fixed points of the parasite relative to its length, remains to be dealt with. These positions are stated to be constant in any given species of microfilaria but they vary in different species. Tables are given showing the percentage length distribution of the fixed points and the differences between them according to the total length of the parasite, and according to the length of the column of granules in the body. The following table represents the percentage lengths from the anterior end occupied by these fixed points in the parasite of the horse, compared with those of the two common microfilariae of the dog; the lengths do not include the sheath :—

	Nerve ring.	Excretory pore.	Excretory cell.	Principal genital cell.	Genital pore.	The terminal stained body cell.
Microfilaria immitis .	22·5%	31·0%	36·8%	64·4%	77·8%	91·8%
Microfilaria repens .	20·1%	29·2%	?	63·0%	75·9%	89·9%
Microfilaria of the horse	20·4%	31·3%	34·5%	70·4%	82·5%	91·7%

Number and distribution of the microfilariae in the blood.—As mentioned above the number of parasites in the blood of affected horses is very variable. In one case it was found that the presence of 15 microfilariae could be determined in 0·1 c.c. of blood no matter where the blood was taken from. In another case where a greater number of accurate estimations was made it was found that the parasites were not equally distributed in the circulating blood if small quantities of blood are taken. If taken at quite short intervals from the same place the number of parasites in a given quantity was found to exhibit great differences. These results were obtained whether the blood was taken from the facial vein or from the jugular. The results were the same in the case of capillary blood (taken from the lip) except that here the number was as a rule smaller. The largest number of specimens counted in the blood from the facial vein was 26 and from the lip 4 per 0·1 c.c. Considerable muscular activity on the part of the animal (galloping for $\frac{3}{4}$ hour) had no influence on the number and distribution.

Periodicity of the microfilariae.—A peculiarity of certain species of microfilariae is that they appear, with a certain degree of regularity, only at certain periods of the day in the circulating blood (e.g., *Filaria loa*, which is present in large numbers in the human blood during the day, and *Filaria bancrofti*, which is present in large numbers during the night). According to LINGARD the embryos of *Filaria sanguinis equi* are found in greater numbers in the blood during the evening and such is also the case with the microfilariae described in the camel (PRICOLO). PENEL and LOOSS state that this periodicity is probably accounted for by the fact that the parasites or their sheaths are held by some product of the host's body in the lungs at certain times and then released into the general circulation. As the human microfilariae exhibiting this phenomenon are those which possess sheaths the author carried out experiments in order to determine whether the same applied to the equine organisms. The number of parasites was thus counted during a number of days at intervals of three hours throughout the day in each case; blood was taken from the facial vein and from the lip. As the number of organisms in the blood may be very variable when samples of blood are taken at the same time from the same place the periodicity counting could only be of value if similar results were repeatedly obtained. However, as the result of these determinations it could not be stated that there was any evidence as to the existence of periodicity, although at 6 a.m. the largest (total 61) and at 6 p.m. the smallest (total 22) in seven countings was found.

Seasonal maximum.—In the author's experience the microfilariae were found most plentifully during the hotter part of the year. According to BAHNMÜLLER'S experiments the parasites were found in 24 horses in summer whereas they could only be found in two horses during the following February.

Distribution in the organs.—From the results of tests on man and dogs microfilariae are present in far larger numbers in the capillaries of the internal organs, especially of the lungs, than in the peripheral blood. In the case of the parasite dealt with by the author it was found that far more specimens could be obtained after death of the horse from the spleen than from the peripheral vessels or other organs. Blood

on one occasion extracted from the lungs during life did not show an unusually large number of parasites. The number found in peripheral capillary blood (lip blood) was always smaller than in the larger peripheral blood vessels.

Histological changes in filariasis.—The tissue surrounding the parasites shows no changes. In sections from various organs a few single specimens can be found in the capillaries and their presence can only be revealed under a high magnification.

Resistance of the microfilariae.—Numerous tests have shown that various microfilariae are endowed with considerable vitality. According to the author's experiments the parasites show great activity in blood outside the body but their movements gradually diminish. In fresh cover-glass preparations they remained alive for 24 hours and in defibrinated blood they were still motile after 48 hours when the blood was kept in a test tube at room temperature or in the refrigerator. In the incubator at body temperature they did not live so long. The parasites in defibrinated blood pass easily through ordinary filter paper. When dried in a thin layer on a slide they die in two minutes; desiccation seems to be most effective in killing the parasites. Addition of distilled water to a preparation on a slide brings about a gradual dying off; their movements at first are very active but after five minutes they become somewhat slower and in about 30 minutes they cease completely. In artificial gastric juice (0·1% HCl) and pancreatic juice they die off very quickly. Addition of neosalvarsan solutions (1 to 1,000 up to 1 to 100) produces the same effect on the organisms as distilled water. Their viability in the circulating blood is not known but is probably rather long (some weeks or months).

The adult stage of the microfilaria.—This microfilaria has been regarded for some time as the embryonic stage of *Filaria papillosa*; no conclusive evidence in support of this opinion has however been produced. The problem was elucidated by the author by post-mortem examination of the affected horse described above. In the peritoneal cavity were found 10 specimens of *Filaria papillosa*, viz., seven females and three males. These were all lying on the small intestine and diaphragm. All the other organs especially the large blood vessels, skin, and connective tissue were searched for filariae without result. All the organs presented a normal appearance with the exception of the spleen; this organ was distinctly enlarged, the edges were blunt and the pulp was rather firmer than normal and of a dark red colour. More microfilariae were found in the spleen than in the other organs. There were fibrinous adhesions between the spleen, liver and diaphragm.

Some of these adult filariae were placed at once in normal saline solution or in horse serum and others were fixed in hot 70 per cent. alcohol for a few minutes and then kept in this solution. Microfilaria preparations were made in the following way: about 1 to 2 cm. of the caudal extremity of the female filaria was cut off and the contents of its body squeezed out on to a slide. The preparation was then examined in the fresh state after the addition of 2 per cent. acetic acid. It was then seen that the embryos from *Filaria papillosa* possessed a sheath and that the relative measurements and buccal structure corresponded with those seen in fresh preparations of the microfilariae from the blood. The length of the organisms freshly obtained from

the adult parasites or kept in serum was about 240 to 300 microns by from 6 to 7 microns broad. Those obtained from adults preserved in alcohol were found to have shrunk to about 225 to 265 microns long by 5·8 to 6·9 microns broad. The embryos obtained from the adult worms were stained after wet fixation in hot alcohol as above according to FÜLLEBORN'S azur II method without drying. Staining presented considerable difficulty. The excess of stain was sucked off by means of filter paper. The examination was begun at once but the desired depth of staining was only obtained after some time. After employing this method single specimens of the embryos were seen to exhibit the same characteristics as those of the blood parasites, especially with regard to the distribution of the cells in the genital organs and the percentage location of the fixed points along the length.

The cause of filariasis in the horse would thus be *Filaria papillosa* and the microfilaria present in the blood is *M. papillosa.*

Considering the frequent occurrence of *Filaria papillosa* in Hungarian horses (according to FIEBIGER about 30 per cent. of all horses harbour these worms) it seems strange that the microfilariae were not discovered much earlier and much more commonly. This can be explained by the fact that a systematic blood examination in cases of filariasis was not often performed and that the number of microfilariae is either very small or they may have disappeared from the blood. That the microfilariae are not so rare as is supposed was found in the examination of the military stud above referred to, although only a few preparations were taken from each horse; and, lastly, it must be remembered that microfilariae only occurred in the blood when sexually mature females and male elements are present in the body. The author mentions an outbreak of microfilariasis occurring in the summer of 1915 at Koniggratz; one horse died of pyaemia and *F. papillosa* was found in its peritoneal cavity. The simultaneous discovery of microfilariae in the blood and *Filaria papillosa* in the abdominal cavity can be traced back as far as 1848 (WEDL) in Vienna. SONSINO (1876) in Egypt made a similar discovery. DEUPSER (1892) reported that the embryos of *F. papillosa* only remained alive for a few hours in water or salt solution while in the blood they lived for 36 hours, showing that the blood is their natural habitat. The same author placed a pregnant female *Filaria papillosa* in the peritoneal cavity of a rabbit and 14 days later microfilariae were discovered in the blood. The same experiment was repeated by the author, however, without result. Lately YAKIMOFF and his fellow workers (1914–1915) have reported microfilariae in the blood of several horses in Turkestan and consider them to be most likely the embryos of *F. papillosa.*

Development of Microfilaria papillosa.—No experiments in this connection have been made but there is no reason to think that it is different from that of *F. immitis* of the dog and *F. loa* and *F. bancrofti* of human beings. As the result of FÜLLEBORN'S* experiments it was

* [Wirth does not seem to have rendered a correct historical appreciation of the researches on the subject of filariasis. In this connection we reproduce a paragraph from an article recently written by Sir Patrick MANSON on "Tropical Medicine and Hygiene" (*Brit. Med. Jl.*, 1917. July 28. No. 2952. p. 107):—

"In 1872 Timothy Lewis, in India, ascertained that the larval filaria discovered by Demarquay and Wucherer in pathological fluids was

found that mosquitoes and other biting flies ingested the microfilariae by sucking blood from an infected animal; after wandering through the body of the intermediate host the parasites are set free from the proboscis and then possess the power of boring through sound skin and entering into the internal organs. Here the parasite reaches sexual maturity and produces a large number of microfilariae which find their way into the blood stream. The intermediate host in Hungary is not known. Direct injections of microfilariae into the blood have hitherto failed to infect. A comparison is drawn between filariasis in man and in horses. In the former case the symptoms and lesions are more especially of a local nature (lymphangitis, etc.) whereas in the horse general symptoms are produced (dullness, sudden collapse, etc.). In the case of man the lesions are set up mostly by the adult worms or their products whereas in the horse it would appear that the symptoms are set up by the microfilariae. From a study of the literature it appears possible that other species of filariae may cause the appearance of microfilariae in the blood. It is only from MANDEL's description (1911) that one can ascertain that *Microfilaria papillosa* was probably being dealt with, whilst other authors might have described other unidentified species of microfilariae.

VAN SACEGHEM (R.). **Contribution à l'étude de la dermite granuleuse des Equidés.** [Granular Dermatitis of Equines.]—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 726–729.

In this paper the author summarises some observations he has made on the above disease as it occurs in equines at Zambi, Lower Congo. A brief reference is made to the literature incriminating a nematode worm as the cause of the disease.

RIVOLTA (1868) described the occurrence in the lesions of a filarial worm which he named *Dermatofilaria irritans*, a name afterwards changed by RAILLIET into *Filaria irritans*. Recently RAILLIET has pointed out the great morphological similarity existing between the parasites found in summer sores of the horse and the larvae of Spiroptera [see this *Bulletin*, 1916, Vol. 4, No. 3, p. 102]. One of the characteristics of this larva is the blunt posterior extremity

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normally a parasite of the circulation. He called it *Filaria sanguinis hominis*. In 1876 Bancroft, in Australia, discovered the parental worm, *Filaria bancrofti*. Subsequently, in 1878, the writer ascertained that a Culex mosquito served as its intermediary host, abstracting the microfilaria from the blood and providing it with an opportunity for undergoing important developmental changes, during which it increases in size from a microscopic object to one just visible to the naked eye, and possessing an alimentary canal as well as remarkable powers of locomotion. In 1900 Low, at the London School of Tropical Medicine, and subsequently James in India, made the important discovery that at this stage of development the larval worm passes into the labium of the mosquito's proboscis, and gets back into man direct, the old idea of the mosquito dying on the water and the embryos escaping into this medium and so reaching man, being thereby, if not absolutely disproved, rendered improbable. Noè, Grassi, and Fülleborn in the case of the allied parasite (*Filaria immitis*) of the dog, and Bahr in the case of the human parasite, have shown the exact mechanism of how this takes place. Finally, the metamorphosed embryos arrive at the lymphatics, where development is completed and the new generation of embryo filariae born."—ED.]

studded with bristles; RIVOLTA's Dermatofilaria possesses the same peculiarity and one is thus led to conclude that the nematode of summer sores is in fact a Spiroptera larva.

Three species of Spiroptera infesting equines are known, viz., *Habronema megastoma* Rud., *H. microstoma* Schneider, and *H. muscae* Carter. *H. megastoma* can be found in the adenomatous looking tumours in the stomach of the horse and ass while the other two species live within the stomachs of equines. The evolution of the larvae of *H. megastoma* and *H. microstoma* is not known but RANSOM has worked out the various stages in the development of *H. muscae*. The embryos of this worm, which lives in the adult stage in the stomach of the horse, are evacuated with the faeces and penetrate within the larvae of flies which live on the manure. In these larvae of flies the pupae and the adult worms are evolved. These finally regain access to the stomach of the horse, probably, according to RAILLIET, when the flies alight on the moist lips of this animal or even more probably when they are ingested.

According to Van Saceghem's observations granular dermatitis occurs only in animals kept in stables; in these stables the bedding was changed and the dung removed regularly. The disease is never localised in the hind quarters but always in the fore quarters, on the legs, and at the inner canthus of the eye; lesions in other situations are rare. Equines which are allowed to live at liberty never present the disease; they usually pass the night in a place where the dung is never removed, but in the morning they leave in order to graze freely in the jungle. These facts would tend to show that the infection is not transmitted directly by means of the faeces and that flies should be held to convey the disease. If the parasite was derived directly from the dung the horses remaining all night on heaps of manure would be the ones more especially affected, and also the hind quarters would be more susceptible to infection. On the other hand, the common house flies and Stomoxys are common in the stables whereas they are rare in the jungle. The reason for the absence of infection of the hind quarters would be explained by the fact that flies are beaten away from this region by means of the undocked tail of the animal.

In a stable where several horses were affected with summer sores the author found that 20 per cent. of the common house flies were infested with a nematode larva 2·5 mm. long by 65μ broad. This larva possessed an elongated, pointed, anterior extremity and a blunt posterior end studded with bristles. The mouth communicated with a passage followed by the oesophagus, the two latter portions measuring together ·85 mm. From 3 to 5 specimens of this larva could sometimes be found in the proboscis of the fly. In normal saline solution under the microscope these larvae show very active forcible movements and penetrate within obstacles.

The above larvae found in the fly were found to differ from those found in summer sores inasmuch as the former were 65μ broad and showed no longitudinal striation whereas the latter were 50μ broad and showed marked longitudinal striation. Larvae taken from a fly and placed on the skin of a guinea-pig moistened with normal saline showed very active translatory movements but no tendency to penetrate the skin. When the moisture had been sucked up with blotting paper the larvae remained stationary and died. These

experiments were, however, made during a time of the year when all summer sores show a natural tendency to healing. It is believed that the larva found in the domestic fly at Zambi is the larva of *H. muscae*. No specimens of *H. megastoma* were found in a few post-mortem examinations recently made at Zambi.

Summer sores usually reveal a large number of calcified parasites and a few living ones. There is thus a massive infection at a single point. It is not very probable that these larvae are all conveyed during one short period of time to this same point. It is more probable that certain sites show a predisposition, such as occurs on wounds with a moist surface. In the case of the inner canthus of the eye this predisposition always exists whereas in the case of the limbs there must be a pre-existing wound. If an infected fly alights on the wound the larvae penetrate and set up a pruritus similar to that described by Looss (1898) in the case of the larvae of *Ancylostoma duodenale* during their passage through the human skin. This irritation will cause the animals to bite the infected place and the large sore thus produced would further attract flies and set up a most suitable point of entry for the parasites. The author often observed that on the part of the body where a summer sore was subsequently set up an intense pruritus was manifested before the appearance of visible lesions. Further experiments on this subject are in progress.

Dickinson (Campbell G.) & Hill (Gerald F.). **Investigations into the Cause of Worm Nodules (*Onchocerca gibsoni*) in Cattle.**—Commonwealth of Australia. Published under the authority of the Minister for Trade and Customs. 7 pp. Melbourne: Albert J. Mullett. Government Printer.

In this short paper Dickinson and Hill briefly describe a small series of experiments conducted by them at Darwin in the Northern Territory of Australia. These were commenced by McEachran and Hill in 1914 for the purpose of determining the nature of the intermediate hosts of *Onchocerca gibsoni*. In these preliminary experiments it was shown that calves placed in screened and open pens thirty yards from infected cattle did not become infected whilst in the case of calves, both Victorian and locally bred, grazing with an infected dairy herd definite nodules were discoverable on post-mortem examination, indicating that infection had taken place. These experiments were conducted during the period January to July and August, and it was decided to carry out further experiments on the same lines, but during the period July or August to January or February.

Six female calves 6 months old were imported from Victoria and on arrival at the laboratory were divided into three lots of two calves each. The first lot was placed in a screened pen enclosed with fine brass wire gauze and entrance to it was through a porch with double doors. The pen was cleansed and whitewashed and the concrete floors repaired before being used. A second lot was placed in an open pen; the third lot was allowed to run free in a paddock with three infected local cows. A three months old control calf, locally bred, was also placed in the paddock with the cows. Throughout these experiments the calves kept in both pens were fed on fodder imported from Victoria

and no locally grown material was used as bedding. The other calves running in the paddock with infected cattle had their grass feed supplemented by locally grown rice chaff and the only drinking water used by them was obtained from a bored well 116 feet deep. The paddock was situated on high ground so as to prevent the calves coming in contact with swampy land; it was tick infested and the calves had to be treated periodically in order to destroy the ticks. During February, seven months after their arrival, a series of early morning observations of the calves were made with the object of discovering a possible ground-living vector that might bite the calf whilst lying down but drop off as soon as the calf rose from the ground. Searches were also made of the patches of ground on which the calves had lain but on no occasion was any possible parasite found.

In March 1916, that is, about eight months after arrival into the Territory the imported calves running out at pasture were slaughtered and in one case two small nodules about the size of a pea were found on the brisket and in the other case one small nodule about the size of a split-pea on the right side of the chest. The control calf, killed two months later, also showed one nodule about $\frac{3}{4}$ by $\frac{1}{2}$ inch on the right side of the chest. This experiment thus confirms the finding of McEachran and Hill that calves reared in the vicinity of the experimental pen and allowed to graze with infected cattle become themselves infected, as also do imported calves from a nodule-free State living under the same conditions. Further, as these calves were confined to a high well-drained paddock up to within a week of slaughter the infection could not be carried by a purely aquatic animal, it being very improbable that these could be found in the deep well water.

In the case of the two calves placed in the open pen in July 1915 the infected cattle grazing in the paddock were allowed to come up to 30 yards of the pen. From the latter part of November till the date of slaughter these calves were exposed to the attack of biting flies and were frequently bitten by *Tabanus mastersi* Walk., *Tabanus nigritarsis* Taylor, *Stomoxys calcitrans* Linn., and *Lyperosia exigua* de Meij. Flies of the last-named species were very troublesome to these calves in February and March, causing characteristic sores on the brisket, under the throat, and at the inner canthi of the eyes. It is almost certain that they were bitten also by several species of Culicidae and probably by sand flies. Buffalo lice (*Haematopinus tuberculatus* Burn) which were found on calves occupying this pen during the former series of experiments could not be found during the period July 1915 to April 1916. On the other hand ticks, *Boophilus australis* Fuller, which were not found on any of the calves used by McEachran and Hill, were rather numerous on both calves throughout the period of these experiments necessitating the use of dipping fluid on several occasions. These calves were slaughtered about eight months after arrival and on post-mortem examination negative results were obtained in both cases. The authors note, however, that certain species of Tabanidae, notably *Tabanus rufinotatus* Bigot, and *Tabanus cinerescens* Maclay, rarely, if ever, attack stock under a roof.

The two calves placed in the screened pen and kept free from the attacks of biting insects and ticks throughout the course of the

experiment were slaughtered also about eight months after arrival, and on post-mortem examination negative results were obtained.

The authors thus summarise their experiments :—

"(1) Calves from a nodule-free State become infected within 8 months of their arrival in the laboratory when grazing on high ground along with infected cattle.

"(2) Calves from a nodule-free State did not become infected during the same period when enclosed in an open pen with concrete floor within 30 yards of a paddock within which affected cattle were depastured although exposed to the attacks of winged and apterous *Arthropoda*.

"(3) In view of the post-mortem findings in experiment No. 2 (open pen) negative results were to be expected in experiment No. 3 (screened pen) in which calves were protected from the attacks of the same *Arthropoda* by fly-proof netting."

The authors, moreover, consider that although the experiments did not lead to the discovery of an intermediate host of the parasite causing onchocerciasis in cattle they definitely excluded the species of flies and tick mentioned above, and also any purely aquatic forms other than those possibly found in the bore water.

A list of the blood-sucking Arthropoda which have been recorded in the vicinity of the experimental laboratory at Fannie Bay is appended.

During the period April to June 1916 six aged and two young wild swamp buffaloes which were shot in the vicinity of Darwin were examined for worm nodules with negative results. Wild zebu cattle and domestic cattle grazing on the same country are invariably infected, the former apparently more heavily than the latter. From one heavily infected zebu bull a well-developed and typical nodule was removed from the tissues under the skin 8 inches behind the junction of the last sternal rib with the sternum and 12 inches from the median line of the belly. In none of their examinations of zebu and domestic cattle were the authors able to discover *O. gibsoni* behind the femoro-tibial joint.

Conreur (Charles) & Urbain (Gaston). **Enterite hemorrhagica dos cães novos—Uncinariose intestinal.** [Haemorrhagic Enteritis of Young Dogs, due to Uncinariasis.]—*Arch. Brasileiros de Med.* 1916. Oct. Vol. 6. No. 10. pp. 560–563.

The authors describe a disease of puppies, due to the presence in the intestine of *Uncinaria stenocephala*, which is very prevalent in Rio de Janeiro, and forms a serious hindrance to the breeding of sporting and other pure-bred dogs. Older dogs appear to be immune, but to puppies of an age between two and six months the disease is very fatal. The symptoms begin with abdominal tenderness and bloody diarrhoea, the nature of the excreta showing that the blood comes from the small intestine. There are also symptoms of gastritis, indicated by thirst, nausea and vomiting, the vomit consisting of alimentary substances mixed with mucus and blood. The temperature rises to 40°–41° C. The pallor of the mucous membranes indicates rapid anaemia. Epileptiform attacks sometimes follow, and the animal usually dies in three or four days. Post-mortem, marked anaemia is to be observed of all the organs, while the stomach is empty and the mucous membrane of the small intestine shows haemorrhagic infiltration. Microscopic examination of its contents reveals the presence of numerous small nematodes, generally associated with tapeworms and ascarides, and ova. The worm is from 6 to 10 millimetres in length.

The disease is not to be confounded with the pernicious anaemia caused by *Ancylostoma tubaeforme* which occurs in older dogs, or with the epizootic gastro-enteritis of Stuttgart. Treatment with vermifuges has very little beneficial effect owing to the acuteness of the symptoms.*

FERRARO (Giuseppe). **I Ditteri ematofaghi della Colonia Eritrea incriminati della trasmissione delle tripanosomiasi locali.** [The Blood-Sucking Diptera of Eritrea incriminated with the Transmission of Local Trypanosomiases.]—*Clinica Vet.* 1917. Sept. 15–30. Vol. 40. Nos. 17–18. pp. 487–493.

Since the discovery of trypanosomiasis in dromedaries in the above-named Italian colony by PRICOLO (1912) the author set to work to study the nature, distribution, and mode of transmission of this disease. He found that a number of flies indicated by the natives as transmitting agents proved to be non-biting harmless species. The following list of diptera, identified by BEZZI, is given of the flies which can be safely incriminated as disease carriers :—

Muscidae : *Stomoxys taeniata* Bigot, *S. sitiens* Rondani.

Tabanidae : *Pangonia beckeri* Bezzi, *Tabanus obbliquemaculatus* Macquart (= *leucostomus* Loew, or *ruficipes* Bigot.), *T. pallidi acies*, Surcouf, *T. gratus* Loew, *T. cordieri* Surcouf, *Pangonia magretti*, Bezzi, *Haematopota abyssinica* Surcouf.

All the above are tropical species and to them must be added *Tabanus sufis* Jeannicke, which has apparently been found also in Morocco, and *Hippobosca maculata*, which is found throughout Southern Asia and in Upper Egypt. The two Pangonia species mentioned are only found in Abyssinia and neighbouring regions. *T. obbliquemaculatus* appears to be the most widespread species in the colony ; it is also known in a large part of tropical and sub-tropical East Africa. No Glossina was discoverable.

According to PRICOLO'S observations the trypanosomiasis observed in camels in Tripoli in 1912 was not an indigenous disease inasmuch as it occurred only in imported camels and did not spread to other camels or other species of animals. This may depend on the fact that the above-mentioned tropical blood-sucking flies do not extend further north than latitude 20° N.

The above-mentioned species are also blamed for the transmission of bovine trypanosomiasis. The camel disease, however, appears to have a much more widespread distribution than that of bovines inasmuch as the former is indistinguishable from other African trypanosomiases known as *mbori* and *el debab* and also from surra, whereas the latter is a more localised disease probably spread by the local species such as Haematopota. The native names of certain biting flies are given.

The author then describes at some length the relationship between the humidity of the atmosphere, depending on the seasons and the altitude of the districts, and the frequency of blood-sucking flies ; the season during which most rainfall occurs varies considerably in Eritrea according to the altitude of the districts. Experience shows that great losses have been caused among camels especially during military campaigns when they are taken into the humid belts.

* Summarised by Dr. J. B. NIAS.

BACTERIAL DISEASES.

HARDENBERGH (J. B.) & BOERNER, Jr. (Fred). **Hemorrhagic Septicemia in Mules.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Sept. Vol. 51. (New Series Vol. 4). No. 6. pp. 817–822.

Organisms of the fowl cholera type have been incriminated with the causation of equine affections by a number of authors. It is recalled that LIGNIÈRES (1897) and others discovered organisms belonging to this group in the blood and exudates from cases of equine influenza, but more recent work indicates that this disease is most probably due to a filterable virus. WEBB (1907) in India described an outbreak of haemorrhagic septicaemia in young mules similar to the one described by the authors; microscopical examination of the blood revealed a rich culture of bipolar organisms but as the examination was not made until about eight hours after death he did not feel justified in concluding that these organisms were the primary cause of the disease. Two years later the same author also reported outbreaks among young horses and donkeys due to a similar organism and characterised by an acute and fatal pneumonia. GILLETTE (1912), also in India, described the case of a horse which showed symptoms and post-mortem lesions of haemorrhagic septicaemia; smears from the heart blood showed a small number of organisms of the above type while those from the intestinal exudate showed them in large numbers and apparently in pure culture.

In August 1916 Hardenbergh and Boerner investigated an outbreak of haemorrhagic septicaemia in young mules in Pennsylvania. Five yearling mules were reported to have died suddenly in the affected centre within 24 hours after showing the first symptoms. Post-mortem examination of two of these cases revealed marked icterus, a sero-gelatinous infiltration of the subcutaneous connective tissue, lymphatic glands haemorrhagic and oedematous, congestion of the lungs, petechiae on the serous and mucous membranes, and slight enlargement of the spleen. The diagnosis was thus based on the fact that the lesions were identical with those observed in the acute form of the disease in cattle, without the presence of pneumonia or any other condition to indicate that the lesions were of a secondary nature. The heart blood and tissue fluids were found to contain large numbers of typical bi-polar staining organisms of the fowl cholera type uniformly distributed and in pure culture. These were readily isolated on culture media and showed the growth characteristic of this group. Inoculation of cultures into rabbits and guinea-pigs gave negative results. Similar results had previously been obtained by Boerner in working with strains of bi-polar organisms isolated from a virulent outbreak of influenza.

The other animals kept in the same stable, including three horses over 12 years old and one mule over five years old, appeared perfectly normal at the time of the outbreak. The authors were unable to determine the source of the infection. The animals were stable fed and their food consisted of hay and oats of rather a poor quality. Cultural and animal inoculation tests with feeding and drinking material gave negative results, but as it had been found that the organism was avirulent for the small laboratory animals these tests did not necessarily eliminate these materials as sources of infection.

WATSON (E. A.). **Report on Ulcerative Cellulitis—Ulcerous Lymphangitis.** *Vet. Jl.* 1917. Nov. Vol. 73. No. 11. pp. 382–396.

This report, issued by the officer in charge of a Bacteriological Laboratory of the Army Veterinary Corps in France, deals with a condition termed "ulcerative cellulitis" by the British Army Veterinary Service. The author claims to have established "on the clearest bacteriological evidence" that this disease is identical with that better known as ulcerous lymphangitis (*la lymphangite ulcereuse* of NOCARD).

It appears that these names are often believed to designate separate morbid entities, this misconception arising owing to a lack of knowledge concerning the symptoms and lesions set up by "varieties" of the Preisz-Nocard bacillus.

In the Army Veterinary Service "ulcerative cellulitis" is held by certain observers to be different from "ulcerous lymphangitis" inasmuch as the lymphatic glands are not involved in the former condition; Watson shows that this idea is erroneous as the standard descriptions of "ulcerous lymphangitis" clearly point out that no distinct lesions are observable in the lymphatic glands.

A systematic description is given of the causal organism together with the symptoms and lesions produced by it. This contains very little that is new. The author omits to give even a brief review of the literature written in connection with the disease under consideration and the characters displayed by the so-called "varieties" of the Preisz-Nocard bacillus.

In some passages the author fails to reveal a capacity for clear argument such as might be expected in a scientific article, for example: "Finally, it is probable that many causes [cases ?] of simple wound infections and abscesses arising from punctures of the skin—due to one or another of the varieties of pyogenic diplo-, staphylo- or streptococcus—are mistaken for 'ulcerative cellulitis.' Such infections may and do not infrequently occur in the disease under discussion, but then they are secondary and not causative factors."

The most important matter discussed deals with the so-called "vaccin therapy" of the disease. The vaccine used in this treatment is made from a surface-agar growth of several strains of the Preisz-Nocard bacillus. This growth is emulsified in salt solution and washed by centrifugation. The sediment is treated with equal parts of alcohol and ether, or pure acetone, which is then evaporated. The object of this process apparently is to obtain certain quantities by weight of the bacteria. The stock vaccine consists of 1 per cent. of these dried bacteria in a sterile glycerinised carbolised saline solution. This is steamed for 2 minutes and again diluted with an equal volume of the same diluting fluid. The author states that the doses and frequency of injection have been worked out by many trials and experiments, and the system of vaccine treatment recommended is based on the results obtained.

[It is much to be regretted that an outline of these experiments has not been published as one would have then been better able to appreciate their value.—ED.]

Vaccine treatment commenced at the onset of the disease is stated to result usually in a cure within a month.

When the specific infection is quite recent and localised one should begin with a 1 c.c. dose increasing by 0·5 c.c. for each subsequent dose at seven days' interval over a period of four weeks. When the disease is well-established, chronic, or recurrent one should begin with a dose of 2·0 c.c., increasing the dose by 0·5 c.c. in the same way until five doses have been given at weekly intervals; finally a dose of 5 c.c. is given after a further seven days.

The reactions are entirely local. Thermal and general reactions are slight or altogether absent. The vaccine method of treatment is contra-indicated in cases of marked debility. In chronic cases or where secondary infections with staphylococci and streptococci exist a dose of polyvalent vaccine may be given in the intervals between inoculation of the vaccine prepared from the Preisz-Nocard bacillus. It is essential that the horse should be well exercised during the whole course of the treatment. The local treatment of ulcers and abscesses should consist of frequent irrigation with normal saline solution.

A brief description is then given of some preliminary experiments with the vaccine method of treatment. In one series designated "vaccination after infection" two horses were inoculated under the skin of the fetlock with a virulent culture of the Preisz-Nocard bacillus, and vaccine treatment commenced on the 10th and 13th day in the case of each horse, respectively. The lesions which had been set up healed completely. No control animals were used.

In another series headed "vaccination before infection" two horses were given injections of the vaccine and then inoculated subcutaneously with virulent culture. Very small abscesses resulted which healed up rapidly. No controls were again used.

Between March and the end of July 1917 over 6,000 doses of vaccine made from the Preisz-Nocard bacillus were issued, and an approximately equal number of doses of the polyvalent mixed vaccine.

A summary of the results of the treatment is given in the case of 350 horses in a table and of this number 57·6 per cent. were discharged as "cured." It is claimed that the percentage would have been undoubtedly higher if a number of horses under treatment had not been disposed of for various other reasons. [It would have been of great help if the author had indicated what in his opinion is the average percentage of cures in untreated cases or in cases treated by other methods.]

According to the author "the officers who have carried out the above treatment after a previous experience of surgical and antiseptic methods, often the most heroic, speak unhesitatingly in favour of vaccination."

[It is, of course, common knowledge that opinions thus derived from clinical experience are liable to grave error when not accompanied by statistics giving the comparative results of treatment by other methods.

Although no previous work on the employment of this line of treatment is referred to by the author the method is not new. It was tried recently by MONTGOMERY in British East Africa (see this *Bulletin*, Vol. 5, No. 1, p. 64) and by TRUCHE in the case of French army horses (see this *Bulletin*, Vol. 5, No. 3, p. 187).—ED.].

DISEASES DUE TO FILTERABLE VIRUSES.

Sohns (J. C. F.) & Soetedjo (Raden). **Infectieuze Anaemie der Paarden.** [Equine Infectious Anaemia.]—*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 2. pp. 141–174. With 2 tables.

In August 1916 the Dutch East Indies Veterinary Laboratory was requested to investigate a sudden outbreak of disease among imported Australian horses. These horses showed disturbances in connection with the nervous and locomotor systems, especially of the hind limbs, which gradually progressed until the horses became useless and dangerous for riding. The disease was at first suspected to arise in connection with the central nervous system. The first animal examined was a 15 year old mare which was unable to lay down, often sleeping standing and falling down, and then unable to get up without assistance. At work it walked with outstretched neck and drooping head and when let loose in a field it circled to the left and had great difficulty in turning to the right. After slaughter a slight degree of hydrocephalus externus was discoverable but otherwise the central nervous system presented nothing abnormal.

The second case was a nine year old Australian mare affected at work with paresis of the right hind leg while the loins and croup were more or less hypersensitive. At times the animal could take a few normal steps with the lame leg and from time to time the lameness shifted to the left leg. Dyspnoea set in readily after slight exertion. The appetite was fairly good. No abnormality in connection with the central nervous system was again discoverable on slaughter; a rabbit injected with sub-dural fluid remained healthy.

The third case was an Australian mare bought in for a nominal sum on account of ataxic movements. The animal was in very poor condition in spite of its good appetite; the lameness was seen to affect one of the hind legs and then suddenly the affected limb became more or less sound while lameness appeared in the opposite limb. The forelegs then became so stiff that the animal was crippled in all four legs and towards the end it walked crookedly to the right or to the left. Finally, the mare was unable to get up without assistance, and after walking a few steps sweated profusely; the breathing became very rapid. The case was diagnosed as osteoporosis. On slaughter the muscles were friable and paler than normal; the kidney showed a few dark solid masses about the size of pigeons' eggs. The backbone was broken in falling; the bones of the limbs were easily sawn through. In the femora and humeri normal yellow marrow was only found in the distal epiphyses; otherwise the spongiosa contained a brownish-red substance, while the fat in the large bone cavities was of a brownish-yellow colour and semi-transparent; the interior of the fat contained dark red centres of varying size. The compact bone had become very thin while the spongy bone was enlarged pointing to a process of rarefying ostitis. Smears from the blood showed anaemic changes; the bone marrow, however, showed nothing special. Inoculation of small experimental animals and culture media gave negative results. The osteomyelitis, firm centres in the spleen, and degeneration of the skeletal muscles aroused the suspicion of infectious anaemia.

In order to confirm the diagnosis the authors injected an Australian horse with 190 c.c. of defibrinated blood from one of the above cases, while another horse received an injection of 40 c.c. of filtrate obtained by passing the defibrinated blood from another patient through a Chamberland filter. After 33 days both inoculated horses showed a rise in temperature and a few days later locomotory disturbances in the forelegs. The horse inoculated with the filtrate then suddenly showed paresis in the hind legs.

Native horses were shown to be equally susceptible; four of these animals were infected with blood from the same animals as the Australian horses were inoculated with. The symptoms were less apparent in the Java horses owing probably to the shortness of the limbs but the loss in weight was very noticeable and also the intermittent pulse.

The authors then enter into a detailed discussion of the history, distribution, etiology, probable modes of infection, pathogenesis, together with the symptomatology, morbid anatomy and diagnosis of the disease in the usually described so-called acute, sub-acute, and chronic forms. It is suggested that the name "infectious osteomyelitis" of horses would be more appropriate for the disease, which is thus defined as "an infectious disease of equines caused by a filterable virus, and which develops as an acute or more or less chronic septicaemia, and presents a clinical picture displaying most strikingly a series of ill-defined lamenesses usually connected with acute or chronic anaemia."

With regard to the mode of transmission the Japanese Commission was led to believe that this took place principally by means of flies, although experiments in this connection proved negative. According to the authors horses became infected at Buitenzorg in fly-free stables and thus infection could only have taken place through the eating of straw soiled with urine. The straw was taken out in the morning, dried and cleaned and taken back into the boxes at mid-day. Horses doing no work were addicted to eating their bedding consisting of rice straw, which is very appetising. The authors admit the possibility of infection by means of Tabanidae although natural infection in the Dutch East Indies probably occurs chiefly through eating soiled straw. The presence of the infectious material in milk is also a source of infection in foals.

In 1910 a fatal outbreak among foals showed peculiarities which pointed to the acute form of the disease. The foals presented unsteady gait, stupor, frequent pulse and loud heart beats, a yellowish discharge of saliva, loss of appetite, high temperature and frequent dyspnoea; the urine was cloudy and contained a large quantity of albumin. Post-mortem examination showed icterus, congestion and swelling of the lymphatic glands and of the spleen, haemorrhages under the renal capsule, parboiled appearance of the heart and skeletal muscles, and urine rich in albumin.

With regard to the morbid anatomy of chronic cases it was found that in most cases at Buitenzorg the bone could be easily sawn through or even cut; sometimes this applied to all the bones, sometimes only o the humeri and femora, and at other times to the ribs. THEILER attaches no importance to the bony changes as he found them in horses which had died of other diseases or were killed before death

as controls. The bones of all the horses suspected of being affected with infectious anaemia by the authors were examined and the changes described above in the case of the third horse examined were found in all.

The authors claim that horses showing the following symptoms should be looked upon with suspicion, viz. (*a*) anaemia with varying colour conditions of one or other of the conjunctivae, (*b*) falling in the stable and difficulty in getting up, (*c*) from time to time a few days fever without apparent cause, (*d*) swellings of the belly, sheath, or hind limbs in the absence of surra, (*e*) diminution or absence of appetite without apparent cause, (*f*) loss of condition in spite of good feeding, (*g*) slipping a great deal in the stable, (*h*) abnormal tiredness, (*i*) stiffness of movement in the form of ataxia, or lameness without apparent cause ; the shifting of the lameness from one limb to another is very characteristic ; the best means of showing this is by lounging once or twice a day for half-an-hour, (*j*) arhythmia or rapidity of the pulse and heart beat ; this is often observed in the stable but increases at exercise, with the appearance of a venous pulse. The inoculation of susceptible horses is the only certain means of diagnosis. One has to resort in practice to other less costly, but unsatisfactory, processes.

The authors discuss the tests devised by Zschokke and by Finzi. The former, who employed the so-called " sinking " test, collected blood in vessels which were cooled down quickly and then the percentage of corpuscles was calculated from the height of the column of corpuscles. The authors added a solution of sodium citrate to the blood instead of cooling it in order to obtain the same result. The test devised by Finzi, consisting in the demonstration of autolytic substances in the serum of suspected horses, was found to give much better results. This test consists in the addition of 5 c.c. of serum to be tested to 1 c.c. of a 5 per cent. suspension of washed red blood corpuscles from a healthy horse. The appearance of haemolysis is stated to point with certainty to the existence of infectious anaemia. According to Finzi haemolysis can thus be produced on the 12th day after experimental infection and in any case after the 24th. Finzi asserts that the corpuscles sometimes become agglutinated under the influence of the affected serum forming small clumps about the size of pins' heads.

The authors were unable to discover albumin in the urine probably because they had not examined a sufficiently acute case. The regular weighing of the animal body in order to discover any loss in weight is also considered to be of importance. The disease can be differentiated from a sclerostome infestation inasmuch as no fever is observed in the latter disease.

With regard to treatment the authors tried the injection of ox gall inasmuch as the Japanese Commission found that sodium taurocholate had a very toxic effect upon the virus. This, however, produced a marked local lesion. Experiments are being performed in connection with the use of sodium citrate. The serum from recovered horses is, of course, dangerous as it still contains virus.

With regard to preventive treatment the authors recommend slaughter of all affected animals. Infected mares are dangerous and their foals are probably born infected or later imbibe the virus with the milk. Purchased horses should be carefully examined by being placed on light work for a few days coupled with a test of the

serum if possible. Australian horses are held under most suspicion as the disease is believed to be imported undoubtedly from Australia. South African, Tonkin, and Japanese horses are also suspicious; Indian and Mongol ponies are recommended. The author in conclusion details a series of preventive measures applicable to this disease.

NEVERMANN (L.), MIESSNER (H.) & WEICHEL (A.). **Studienreise nach dem Balkan.** [Travel Studies in the Balkans.]—111 pp. With 80 text figs. & 2 tables. 1917. Hannover: M. & H. Schaper. [Price Mark 3.50.]

This publication consists of a description of a journey undertaken by the above three authors to Bulgaria and Turkey at the request of the German Minister of Agriculture in October 1916, with the object of studying the contagious diseases of animals of these countries and the methods there employed in dealing with them.

A considerable number of details are included respecting places of general interest in, and the economic aspects of, the countries visited from the point of view of agriculture and stock-breeding. As regards contagious diseases information was obtained on sheep pox in Bulgaria and rinderpest in Turkey. These two diseases are apparently responsible for by far the most serious epizootics among stock in these countries. A few remarks are given on equine piroplasmosis on the Macedonian front of the Bulgarian army.

The following figures represent the live stock returns for the year 1910 in Bulgaria:—horses 478,222, asses 118,488, mules 12,238, cattle 1,606,363, buffaloes 412,978, sheep 8,669,260, goats 1,464,719, and pigs 527,311. Before the year 1880 stock breeding in this country was in a very neglected state but considerable progress has been made since its independence. The control of stock-raising is at present very largely in the hands of Government veterinary surgeons; the two national studs are managed by veterinary surgeons. The cattle are principally of the Podolian breed and are used for food and draught purposes. Sheep-breeding is of the highest importance, mutton representing the chief meat food of the people while sheep-milk and cheese form a large part of the human food. Pig breeding is of minor importance probably largely on account of the fact that pig food is not grown. The poultry industry is very important.

Details are given with regard to the Bulgarian Veterinary Service, an organisation of recent origin, but which proved its efficiency in the eradication of rinderpest after its introduction into the country during the late Balkan war. There is no veterinary school in the country, students being trained abroad, principally in Germany and France. Further details are given with regard to the veterinary bacteriological institute in Sofia, which is under the direction of Dr. ANGELOFF. This consists of a well-equipped laboratory where sera and vaccines for dealing with the more important animal diseases and even some human diseases are manufactured. In connection with this institute there is a rinderpest station, situated at Burgas on the Black Sea coast, which was erected by ANGELOFF for the suppression of rinderpest in Bulgaria during the 1912–1913 Balkan war.

Equine piroplasmosis.

A short visit was paid to the Macedonian front to study equine piroplasmosis. Information was obtained that the disease occurs chiefly during the months June-August. In the summer of 1916 about 200 horses belonging to the Bulgarian-German troops were affected. The native horses of this region are only slightly or not at all affected. The symptoms commence with loss of appetite, dullness and rising temperature, followed by a yellowish discolouration of the eyelids, and petechiae on the mucous membranes of the eyes, mouth, and nostrils. Later, loss of condition and oedema set in. Piroplasms in varying numbers may then be discovered in the corpuscles. Some of the animals die, the others become chronically affected, emaciated, and die from exhaustion. On all animals were found ticks of the species *Dermacentor reticulatus*. At the time of the authors' visit no animals were suffering from the acute stage but several horses were seen which had become affected in the preceding June and had recovered; no piroplasms were discoverable in the blood of these animals. The weather during the preceding summer had been hot, rain falling on only a few days. Horses were picketed in fields; where only a small proportion of animals were slightly affected these fields were rather dry, but acute cases occurred in the wetter fields which were also covered with shrubs. Haemoglobinuria was rarely observed. In the Second Bulgarian Army during the spring and summer of 1916 out of 1,500 horses belonging to five mounted units about 200 became affected with piroplasmosis, from which about 40 died.

Sheep pox in Bulgaria.

This disease is of very great importance on account of the relatively great dependence of the country on its sheep industry. (There are about 26 times more sheep per head of human population in Bulgaria than in Germany). The danger of the importation of the disease into Germany during the present war had also to be taken into consideration owing to the very close relationship existing between that country and the Balkan States. The disease has already appeared around Breslau on account of sheep imported from Macedonia and also in those parts of Russia occupied by German troops. The ten million sheep in Bulgaria are distributed mostly in flocks of from 50 to 100 head owned by the peasants and remain at pasture the whole year. Material for study was easily obtained on account of the widespread distribution of the disease throughout the country. An account is thus given of two affected flocks kept at places lying a short distance from Sofia. In one of these places the sheep had been vaccinated and when examined about a fortnight later all appeared sound with the exception of two or three sheep, which were dull and not grazing. A brief description is given of the symptoms exhibited by these animals and a full description of the disease in a naturally affected animal on the same place. A very full account is also given of two affected animals in a second outbreak. The descriptions are accompanied by a number of photographs of the lesions. The symptoms and lesions correspond with those given by other authors and also in text books. These are, briefly, slight muco-purulent discharge from the nose and eyes, papules and pustules from the size of a lentil up to a bean on the upper and lower lips together with crusts and scars as the result of the bursting

and healing of these lesions. Similar eruptions could be discovered on the woolly part of the skin; the submaxillary glands were swollen and painful; the skin on the inner surface of the fore and hind limbs, around the vulva, and under the tail likewise revealed eruptions in various stages occurring simultaneously. The papules were red and painful, and later formed cupola-shaped pustules which burst forming shallow ulcers, and these became covered afterwards with a scabby mass about the size of a shilling. No internal lesions were seen in the very few cases examined post-mortem by the authors, although pneumonia is very often observed and inflammation of the subcutaneous lymphatic glands; widespread and very numerous lesions of the skin are observed in such cases.

On account of the widespread character of sheep pox in Bulgaria vaccination is at present extensively performed although by this means new virus carriers are artificially produced. The number of sheep vaccinated yearly varies from 500,000 to 800,000. The losses caused by this operation reach from between 0·4 to 0·6 per cent. while, on the other hand, the losses caused among affected flocks left unvaccinated vary from 5 to 50 per cent. As soon as an outbreak is reported the whole of the affected flock is vaccinated free of charge, usually together with all flocks in the neighbourhood. The vaccinated sheep are placed under the same regulations as the affected animals and are held to be infective for three months, during which time the animals are strictly isolated.

The lymph is always obtained from artificially infected sheep, and not from natural cases as is more usually done, inasmuch as material free from outside contamination can be prepared in this way. The sheep employed for lymph production is shorn over the right side of the chest and abdomen. The patches to be inoculated are shaved and swabbed with 3 per cent. boric acid solution. The sheep thus prepared is secured on a table with its right side facing upwards and lymph from a previously infected animal is usually applied to twelve different places at a distance of about two fingers breadth apart. The inoculation is performed by means of a specially constructed syringe which can be regulated so as to deliver half or whole drops of fluid. The syringe is fitted with a very fine thin needle about 1 inch long which is inserted with a slight turning movement within the skin along its whole length until its point emerges from the needle tract; the needle is then pulled back to within a short distance of the point of entry and one drop is squeezed into the canal. If a trace of this drop appears at the exit of the needle path then the cutaneous application has been correctly performed. Each skin patch receives four such needle tracks of which two lie above one another so as to form a continuous line while the other two run across this path perpendicularly to its middle.

The seat of injection shows a slight swelling in from 4 to 5 days. The temperature rises on the 3rd to the 4th day after injection to from 40° to 41° C. Later a red raised hot painful papule about the size of a two shilling piece appears. Lymph is usually collected on the ninth or tenth day. The collection of material later is not recommended on account of the necrosis of the overlying skin and subsequent infection.

In order to secure the lymph the sheep is fixed as before and the

skin and swelling shaved, washed, and douched with boric acid solution, mopped with cotton wool and dried with a sterile cloth. One presses an area of skin between the thumb and forefinger so as to form a fold containing the papule and clamps the base of this fold by means of two strong pairs of forceps. A horizontal incision is then made along the length of the fold and the fluid exuding from the wound is sucked up into a syringe fitted with a wide bored needle. A further quantity is obtained by deeper incision. Another incision is then made outside the first incision laterally under the skin. By placing two additional pairs of forceps within the first two one can squeeze out the fluid still remaining in the tissues after the incision and then suck it up. In order to obtain the last drop of lymph from the papule a third pair of forceps is placed between the second pair. In this way from 10 to 15 c.c. of lymph can be obtained from a papule, or 100 to 150 c.c. from the twelve papules obtained on one animal.

The lymph is then mixed with from 2 to 6 times its bulk of 3 per cent. boric acid solution, filtered through gauze, and distributed in tubes, each containing 1 c.c., which is sufficient for about 100 animals. The degree of dilution depends on the quality of the eruptions. If the animal presents marked eruptions and a typical rise of temperature together with symptoms of a severe general infection, the lymph obtained is very virulent and is most highly diluted. On the other hand if the papules are feebly developed and the sheep is only affected with slight general symptoms, the lymph is slightly diluted.

The inoculation of flocks is performed by means of the same kind of syringe as is used for the lymph-producing animal but furnished with a very strong short needle with a lancet-shaped point. The needle attached to the syringe is inserted through the skin of the ear, a small ring situated just above the point preventing it from penetrating too deeply. The point is then turned so that the opening of the needle faces the cartilage of the ear and a half or one drop of lymph is then pressed out of the syringe. Adult animals are given 1 drop, lambs only $\frac{1}{2}$ drop. These quantities are stated to be easily given by means of the mechanical arrangement fitted on to the piston of the syringe. On account of the deterioration of the lymph on keeping ANGELOFF uses only fresh or less than 2 to 3 weeks old lymph, and thus only a small stock is kept in reserve.

Rinderpest in Turkey.

The consideration of this disease as it occurrs in Turkey is preceded by a chapter in which the agriculture and veterinary service of the country is described at some length. Agriculture, although constituting almost the sole industry, appears to be in a deplorably backward condition partly owing to former misgovernment and partly owing to the fatalistic temperament of the inhabitants. The animal population at present is composed of 6,132,507 cattle, 864,000 buffaloes, 1,500,000 horses, 144,000 mules, 1,370,000 asses, 20,000,000 sheep, 17,000,000 goats, 320,000 camels, and 40,000 pigs. The improvement of stock by breeding hardly exists. In Anatolia native cattle consist of small wretched looking animals hardly more than $3\frac{1}{2}$ to 4 feet high; draught oxen are composed of the grevish-white Podolian breed. Similarly the horses mostly used consist of the small but very hardy and tough Anatolian horses, which are used

for draught and pack purposes and crossed with Arab blood for riding purposes. Sheep and goat breeding is very extensive as in Bulgaria but pig breeding is extremely small owing to the Moslems' religious distaste for pork.

The veterinary service of the country is of very recent origin. In 1858 a military veterinary school was opened at Constantinople under the direction of French teachers. A civil veterinary school was opened in connection with the medical faculty of the University of Constantinople in 1889 and after various changes an independent school was built in 1900. Eleven years later this institution was burnt down but owing to internal disturbances it has not yet been reconstructed. In 1910 owing to the great need for veterinary surgeons a two years course was instituted for so-called army surgeons who are appointed to assist the fully trained veterinary surgeons. Veterinary teaching in the civil school is in abeyance during the present war. The military school at Scutari is a modest building in which students undergo a four years course which, until recently, was conducted in the French language.

There are three research and serum Institutes in Asia Minor, viz., at Pendik, established in 1910, Eskeschir, established in 1913, and in Aleppo (removed from Ersingian), established in 1911. The work of these Institutes consists mainly in the manufacture of rinderpest serum. Details are given regarding the organisation of the civil and the military veterinary services.

Rinderpest is always enzootic in Turkey in Asia and has always found easy means of transportation into Turkey in Europe. Owing to the very strict police measures adopted in Bulgaria the disease has been prevented from spreading towards the remainder of Europe. For a long period during the late Balkan war, however, the eastern portion of Bulgaria became affected owing to the importation of the disease with the stock of fugitives. Considerable apprehension is expressed lest the disease should gain access to the territories of the Central Powers owing to the importation of cattle used for slaughter and transport by Turkish troops fighting in those countries. The danger is increased owing to the lack of knowledge of the veterinary surgeons of those countries regarding the primary symptoms exhibited in the scene of an outbreak.

Next follows a description of the pathological institute at Pendik situated in Asia Minor on the borders of the Sea of Marmora. This consists of well-equipped laboratories and buildings erected in 1910 at a cost of about £10,000. Accommodation is provided for about 300 serum animals.

For virus production the above-mentioned small Anatolian cattle are used. These are infected subcutaneously with from 5 to 10 c.c. of fresh defibrinated blood from a sick animal; in from three to five days a rise of temperature to 40° or 41° C. takes place and during the following two to four days distinct clinical symptoms affecting in some cases the respiratory and in others the digestive tract appear, and also symptoms affecting the conjunctiva and the buccal mucous membrane; the appetite completely disappears. Very soon the temperature drops suddenly and death occurs within the next 24 to 48 hours. In order to render suitable virus the animals should show distinct clinical symptoms besides fever and inappetence, and such a virus is obtainable

as soon as diphtheritic lesions on the mucous membranes or marked diarrhoea appear. The virus animals are bled from the carotid artery into a flask containing a certain quantity of alkaline sodium citrate. The jugular vein is in the meantime connected with an apparatus for the infusion of sterile salt solution in order to obtain as much virulent blood from the artery as possible. In this way from 6 to 8 litres of blood mixed with salt solution can be obtained from a small Anatolian ox. The virus remains in the blood from 10 to 15 days, but the blood is as a rule injected immediately into the serum animals.

In order to obtain sufficiently large quantities of serum only cattle of the large Podolian breed are used for serum production. A so-called ground immunity is produced by the subcutaneous injection of 1 c.c. of virulent blood on one side of the body and 50 to 80 c.c. of anti-rinderpest serum on the other side. The inoculated animals are observed during the following days and should serious symptoms arise a further application of serum is made in order to avoid a fatal termination. If, however, the animal only reacts slightly then a further subcutaneous injection of 20 c.c. of virus is made on the 20th day and if no appreciable reaction follows a dose of from 1 to 3 litres of virus is at once injected intra-peritoneally. If on the other hand the animal reacts strongly to the first injection then a dose of from 1 to 3 litres is injected intraperitoneally on the 20th day. The serum animals are bled in the standing position and four litres of blood are withdrawn at each blood-letting. Five days later a further four litres of blood is taken, and again after another five days a similar quantity. The animals are allowed to recuperate for ten days, and then receive a fresh large dose of virus intra-peritoneally; bleeding is repeated as before, commencing after an interval of 12 days.

On account of the frequent occurrence of piroplasmosis one has to be careful to employ animals whose blood is free from piroplasms for virus production. The blood of these animals is thus examined during the whole period they are under experiment and as soon as piroplasms are detected they are treated with trypanblau. If the piroplasms disappear from the blood up to the climax of the rinderpest infection then the blood is used for the injection of the serum animals; on the other hand, if the parasites remain in the blood the animal is discarded from further use. One has thus to reckon with 30 per cent. piroplasm infection among the virus animals, whilst a further 20 per cent. of the virus animals are of no use inasmuch as they contract too mild a disease for the production of suitable virulent blood. The institute delivers about 600 litres of serum per month, uses up about 700 virus animals in the course of a year and keeps up a stock of about 150 serum animals.

The method employed in Bulgaria for the production of anti-rinderpest serum was as follows:—

While no serum was available a ground immunity was set up by the inoculation of 10 to 15 c.c. of gall subcutaneously followed 10 to 15 days later by a subcutaneous injection of from 1 to 5 c.c. of virus. Later on this immunity was set up by the injection of 10 c.c. of serum on the left and 1 c.c. of virus on the right side of the neck. The further procedure differed according as to whether the rapid or the slow method of obtaining serum was employed.

(*a*) Rapid method.—(1) As soon as the animals recovered, 1 to 3 litres of virus subcutaneously, after two weeks, (2) 1 to 7 litres of virus subcutaneously, after 12 days a first bleeding of 4 litres, after a further five days a second bleeding of 4 litres, after a further five days a third bleeding of 4 litres, after three weeks (3) 1 to 7 litres of virus subcutaneously, and later after 12 days bleeding as before.

(*b*) Slow method.—(1) Half litre virus subcutaneously, after 10–14 days, (2) 2 litres of virus subcutaneously, after 10–14 days (3) 2 litres of virus subcutaneously, and so on until 6 litres had been given.

More recently the rapid method was used for the most part. After the production of a ground immunity by the injection of 10 c.c. of serum and 1 c.c. of virus and recovery of the animal 2 to 8 litres of virus were injected subcutaneously. After 10 days the animals were bled for serum.

The authors next devote a considerable amount of space to the symptomatology and morbid anatomy of the cases observed by them during their visit. This description is accompanied by a number of quite good figures. Nothing new, however, is added to what is already known regarding these matters.

In Asia Minor rinderpest is frequently complicated with piroplasmosis. Animals thus affected pass a red-coloured urine and on post-mortem reveal marked swelling of the spleen. Piroplasms are easily discoverable on blood examination. These animals undoubtedly had been subject to a previous attack of piroplasmosis, the parasites as is well known being capable of remaining in the body for years without setting up apparent symptoms.

Outbreaks of rinderpest in Turkey are dealt with in the following way :—As soon as the disease is reported in a locality all animals showing a rise of temperature are isolated. All animals showing clinical symptoms such as lachrymation, lesions on the buccal mucous membrane, and diarrhoea are immediately slaughtered. The cattle showing no fever and which are otherwise apparently healthy are quarantined and injected with anti-rinderpest serum (ox 80, buffalo 100° c.c. subcutaneously). From the 2nd to the 9th day the temperature is taken daily and if a temperature of over 40 C. is registered on two occasions the animal is slaughtered. On the 15th day the serum injection is repeated. No further temperature readings are made. A month after the appearance of the last case of rinderpest the quarantine restrictions are raised.

BROGAN (G. H.). **Notes on Contagious Bovine Pleuro-Pneumonia in Northern Rhodesia.**—*Vet. Jl.* 1917. Oct. Vol. 73. No. 10. pp. 369–371.

This disease was introduced into Barotseland in 1915 from Portuguese West Africa where it appears to have been enzootic for several years. From there it was brought down to several cattle districts on the railway line by traders and a number of deaths from the disease seems to have occurred during transport.

The disease then spread rapidly among cattle in the areas into which it had been introduced, probably owing to the absence of a qualified veterinary staff. Energetic measures were, however, carried out as soon as possible involving quarantine of all herds in each

suspected area, slaughter of all affected animals, inoculation of all in-contacts and suspected in-contacts as far as the supply of virus permitted, branding of all animals so inoculated, and finally the establishing of a " buffer " area in which no cattle movements of any kind were allowed for some time in order to cut the disease off from the remaining cattle districts. The slaughtering of affected animals met with considerable opposition owing to the attitude of the cattle owners who maintained that some animals recovered and became immune.

Pleuro-pneumonia inoculation, although nothing like so satisfactory as the simultaneous method in rinderpest, is considered to be in the writer's experience a beneficial measure in infected areas in those countries where wholesale slaughter is out of the question. The inoculation sometimes has to be performed repeatedly in order to obtain a satisfactory reaction. Glycerinated virus was used. The so-called " thread " method was found to be more convenient in practice than inoculation by means of a syringe. When the inoculation was carried out by the owners themselves gangrene often occurred owing to secondary infection and heavy mortality resulted.

The disease first appeared in the Kalomo district in May 1915, and the heaviest losses took place before the end of July. Measures to eradicate the disease were then undertaken with the result that the last case occurred on November 11th 1916, and no further cases were reported during the following seven months; the possibility of the existence of a few so-called " lungers " is, however, borne in mind.

A few statistics are given,—deaths from pleuro-pneumonia, total 561, deaths after inoculation 644; 9,709 remained alive, apparently after inoculation.

MISCELLANEOUS.

(a) Bovine Haematuria.

Hadwen (Seymour). Bovine Hematuria.—*Jl. Amer. Vet. Med. Assoc.* 1917. Sept. Vol. 51. (New Series Vol. 4). No. 6. pp. 822–830.

The condition described by Hadwen is defined as a disease of cattle which appears most frequently at the end of winter and is characterised by the emission of blood of vesical origin in the urine. In 1914 (Report of the Veterinary Director-General of Canada) the author advanced the so-called oxalic acid theory to account for the origin of the disease and a further series of experiments are detailed in this paper in support of his contention.

In the primary stages of the disease the animals show no apparent symptoms except that they urinate more frequently than normally and pass blood at the end of the act of micturition. In the later stages of the disease the animals develop a depraved appetite, become emaciated and anaemic owing to repeated loss of blood and later affected with diarrhoea, and finally die of cachexia. It is difficult to state the average duration of the disease owing to the fact that the earlier symptoms may be overlooked, but as a rule animals do not die within

a year after they have first manifested symptoms while in some cases they may live on for years in apparent good health except for the emission of bloody urine. In the late stages of the disease complications may arise especially due to the invasion of the bladder and kidneys by pyogenic cocci. The average age at which animals become affected is 6 years. The disease is associated with poor farm lands such as woodland, newly cleared farms or farms that are either neglected or falling out of cultivation.

The mucous membranes of the urinary tract vary markedly in different cases. Sometimes they are in the form of rough raised red ridges, in others they appear normal except for eroded bleeding patches and sub-mucous haemorrhages. In long-standing chronic cases there is fibrous thickening, a tendency to proliferation and the formation of papillomatous outgrowths. The walls of the bladder may thus lose all power of dilating and in such cases there is an almost constant dribbling of urine containing, as a rule, but little blood. In other chronic cases the bladder becomes permanently dilated owing to the occlusion of the urethra with blood clots. Cicatrices are rarely encountered, showing that as a rule there is no tendency for the lesions to heal. The lesions appear most active towards the end of the housing period, viz., the month of February. The other organs of the body generally appear healthy.

The amount of blood passed with the urine in two cases during 24 hours was found to be 1,101 and 738 c.c. respectively, but it was found that these amounts might diminish considerably from time to time. Clots in the urine are common in the late stages when blood is present in larger quantities; in the early stages the salts in the urine are present in sufficient quantity to prevent coagulation. On sedimentation, as a rule, the red corpuscles have a normal appearance. Haemoglobinuria is sometimes seen in the advanced stages; the urine is generally strongly alkaline in reaction. At first the urine is nearly always sterile but after a time the bladder becomes contaminated especially with streptococci which have also often been found in the kidneys. The calcium oxalate crystals which are believed to play a very important part in the production of the lesions are more abundant in the early stages of the disease.

Roger, however, notes that the number of crystals is not always a true indication of the amount of oxalate in the urine.

In the early stages the circulating blood appears normal but later the red corpuscles present the usual changes seen in secondary anaemia.

In 1914 the author recorded experiments which showed that oxalic acid was very toxic on drenching but that later on the animals became accustomed to it. It was found that 30 grammes could be safely given daily if the animals were allowed an occasional rest. One cow was thus given 395 such doses but remained in excellent condition and on slaughter the bladder was found to be rough and thick while no other lesions were found in the body. Another cow was given 577 daily doses (May 1914–March 1917) and remained fit and well for up to 2 years and 3 months. Later despite care and extra food the animal gradually declined in condition and commenced passing red urine until she became so weak as to be unable to get up and was slaughtered (March 1917). On post-mortem examination the carcase was thin and dropsical but all the organs appeared normal except

one kidney, which was slightly cystic, and the bladder; the mucous membrane of the latter showed petechiae and vegetations and a large quantity of oxalates were found in the red urine.

A steer was given a series of 697 doses (November 1913–March 1917) commencing with small doses at the age of 2 months. The animal remained in very good condition but its growth was distinctly stunted and no symptoms of disease became apparent after this treatment except that albumin and abnormal quantities of crystals were passed in the urine. The author remarks that the feeding of oxalic acid bearing plants would be the best way of reproducing the disease but owing to the difficulty of getting these in sufficient quantity commercial oxalic acid was used.

In 1914 the author claimed to have shown that passage of blood in the urine as in natural cases could be set up experimentally by the irritation provoked by the repeated daily injection of calcium oxalate crystals into the bladder. Three experiments are recorded in which it was shown that injections of dilute oxalic acid solutions into the bladder provoked great irritation and that subsequently the urine was stained with blood. Calcium oxalate crystals were found in the bladder as soon as the acid came into contact with the urine and mucus. After a time the urine became contaminated with bacteria which no doubt played a part in aggravating and maintaining the lesions. Two out of the three cases developed a disease indistinguishable from natural cases of haematuria.

According to the author the only objection Moussu raises to his theory is that if haematuria were set up only in consequence of animals eating irritant plants then in the majority of cases they should recover when removed to healthy regions; but Moussu admits, however, that it is probable that the lesions once firmly established cannot be cured. As the result of close observation of 66 cases in British Columbia the author himself found that not a single case lived over five years after showing the initial symptoms. Remissions occurred during which periods the animals might appear to be in perfect health but they always broke down again and never lasted for much more than a year. In British Columbia the disease is confined almost entirely to the bench lands bordering on the Pacific. Cleland noted the same thing in Australia and Case in Hawaii. The author thus does not hold forth any hope for treating the disease successfully, but recommends prophylactic measures consisting in the agricultural improvement of the pastures grazed over by affected animals.

(b) "Renguera."

Tabusso (M. E.). **Paraplegia enzootica negli agnelli.** [Enzootic Paraplegia in Lambs.]—*Clinica Vet.* 1917. Aug. 31. Vol 40. No. 16. pp. 457–472. With 1 text-fig.

This preliminary communication issued by the Director of the National Institute of Agricultural Microbiology, Lima, deals with a disease affecting almost exclusively lambs in the Andes regions of Peru and known locally under the name of *renguera* (lumbago). Clinically the disease is characterised by disorders of the locomotory system starting as a paresis and ending up with general paralysis. The disease appears to be of a contagious character inasmuch as in

infected flocks from 98 to 100 per cent. of the newly born lambs may become infected. The course of the disease lasts on an average from 1 to 2 months although in some cases, especially in very young lambs, it may not extend beyond a fortnight; the disease always terminates fatally, death being brought about not so much by the disease itself as by inanition due to the lambs' inability to feed.

The Peruvian *renguera* was first studied by L. MACCAGNO in the infected regions and his observations corresponded exactly with those of the author. There are very few accounts in veterinary literature of diseases corresponding with this affection. An Argentine observer, J. M. QUEVEDO, has described a group of affections known as *la pataleta* and characterised essentially by cerebro-spinal disturbances, affecting stock in the southern regions of the Argentine and taking the form of localised outbreaks. Enzootic paraplegia of sheep was first studied in 1908 by BABY, who recognised it as a new disease affecting exclusively ovines and showing symptoms comparable to those produced by the administration of repeated doses of a convulsant poison; he further noted that the affected animals grazed over low and marshy pastures and got better when transported to high and dry localities. LIGNIÈRES (1900) denies its contagious nature as no specific micro-organism was discoverable. SIVORA (1911) attributed the disease to the toxic effects of the Preisz-Nocard bacillus.

The Argentine *pataleta* (or *tembladera*, *vértigo*, *chucho*) first manifested itself in Patagonia in 1907 and attacked horses, cattle, and young lambs, the symptoms in these various species of animals being similar in each case, but sheep were most often attacked. On being urged to run the animals began to tremble in the hind legs as if suffering from paraplegia and before long fell to the ground as if their tendo Achilles had been cut, thus assuming a dog-sitting position; death was due to inanition and the disease was seen especially towards the end of the summer and during the autumn. No lesions were discovered in connection with the nervous system or other tissues and causal organisms could not be demonstrated. QUEVEDO believed that the disease might be due to the ingestion of various Graminaceae and Leguminosae such as *coiron* grass, which is only eaten during periods of great drought. Reference is made to other authors who have studied the disease in other parts of the Argentine. Some of these ascribed the disease to a fungus found on a certain species of grasses. Reference is also made to a paralysis of sheep occurring in South Africa which is believed to be tick transmitted. The author mentions the fact that S. H. GAIGER had been set to work on the disease in infected centres at the time of his writing [see following extract].

In Peru the disease is at present confined to a few provinces in the Department of Junin, forming a tableland situated at an elevation of from 4,000 to 4,500 metres above sea level in the Cordigliera of the Andes and just below the ice line. The climate is cold, varying from – 5° C. to +15° C. and has only two clearly defined seasons, viz., one termed winter with a relatively high temperature but with heavy rains and daily storms (October–March) and the very cold summer with hard nocturnal frosts (April–September). The whole zone consists of natural pasturage with a predominance of Graminaceae and is rich in water which comes from the snowclad regions above. The subsoil is very rich in minerals. The pasture is grazed over

exclusively by sheep and a few llamas. Each ranch contains on an average from 20,000 to 40,000 sheep distributed over vast stretches of land in groups of several hundred animals living entirely in the open air. In the case of a fresh outbreak in a flock there is always a history of its having been contracted from a neighbouring infected flock; the infected region becomes more extensive every year and at present covers a surface of several thousand square kilometres. The author then gives statistics dealing with the extremely high mortality and serious economic losses caused by the disease in large flocks.

The disease appears to have first appeared in Peru about 1911 as no history of a similar disease can be traced to have existed before that time. The disease cannot be of a digestive or mineral origin as the pastures have remained in the same condition in these districts for centuries. There appears to be good reason to believe that the disease was most probably imported from the Argentine, inasmuch as shortly before it was first reported a few sheep were introduced for the first time for cross-breeding purposes from Patagonia and other neighbouring provinces into the ranches in which the original outbreaks occurred. As stated above, a disease which is probably exactly similar has been studied in the Argentine since 1908. In 1910 there was a large importation of Argentine cattle, horses, sheep, etc., into Peru and these introduced into the country, among other diseases, foot-and-mouth disease.

Animals attacked.—According to shepherds cases of *renguera* are said to have been observed amongst the llamas and sheep dogs in the affected regions but the author doubts the accuracy of these statements. The regions affected communicate with a rich cattle breeding region known as the *sierra* lower down at a height of 3,000 to 3,500 metres and in one ranch situated on the border line a fatal disease corresponding with that seen in lambs was observed affecting three calves. The disease affects sheep of every breed and condition to the same extent but shows a marked predilection as regards age; lambs up to 6 to 8 months old are most susceptible, especially when they are from 2 to 4 months old, but yearlings are also attacked to a less extent. Adults very rarely become affected.

The disease is most prevalent during the rainy season (the local winter), that is, during the period in which lambing mostly takes place. The number of affected animals increases considerably after cold and damp nights.

The following were the more important symptoms observed by the author in the course of a study of naturally occurring outbreaks and a few cases in the laboratory. In typical cases the disease assumes a sub-acute character with an average duration of from 1 to 2 months. In some outbreaks, however, the acute form predominates affecting more than 90 per cent. of susceptible animals, producing a mortality of about 100 per cent., and completing its course within a month. Rarely, cases of a chronic character are seen, terminating fatally after a long period, while in some instances such as with cases transported into a suitable climate and properly nourished, gradual improvement in the symptoms may be seen.

The disease appears to manifest itself suddenly without preliminary symptoms and affects primarily the hind limbs. No cases in which the fore limbs were first affected have been seen. Neither at the

beginning nor during the later course of the disease does the affected animal show noteworthy general symptoms. The disease thus begins with lack of co-ordination of the hind quarters, and dragging of the hoofs with consequent lesions on the coronets. The animal remains at the end of the flock and assumes a characteristic posture with the legs apart. Later paresis sets in and when the animal is urged to move the affected legs give way and it falls on its hind quarters or on its side; with some effort the animal soon resumes its standing position, but again falls as before when it attempts to move and after a number of falls rests stretched out on the ground with its hind quarters completely immobile. Next the animal falls so frequently that paraplegia sets in definitively and then death from inanition invariably ensues owing to the inability of the lamb to graze or follow its mother. In acute cases the inco-ordination, paresis, and paralysis are manifested in the fore limbs also and in such acutely affected cases giddiness and trembling are often observed either generalised all over the body or confined to the head. No specific lesions are seen on post-mortem examination. The carcase shows signs of inanition and the muscles of the affected quarters are atrophied. Naked-eye examination of the nervous system showed nothing abnormal except slight congestion of the meninges; in very severe cases congestion of the spinal cord especially the lumbar portion can be observed. The lumbar plexus shows no lesion.

The experimental studies made by the author gave no indication as to the etiology of the disease. Examination for causal organisms either directly or by attempted artificial transmission of the disease always gave negative results. Microscopic examination of the blood in a great number of cases revealed no micro-organisms except a few diplococci in two or three cases. Moreover, it is highly improbable that a protozoan blood parasite can be connected with the disease, inasmuch as it only attacks lambs in a cold region where the ecto-parasites which usually transmit organisms of that kind are completely absent. *Melophagus ovis* is the only widely diffused species. Examination of the cerebro-spinal fluid gave similar results while the smears from the other organs and tissues gave constantly negative results.

A few cases were kept under observation at the laboratory with a view to making cultural examinations. Blood cultures from 15 cases examined after natural death remained sterile or developed growths of the common putrefactive organisms. In three cases the cultures from the cerebro-spinal fluid and from the blood revealed a Gram-positive diplococcus. A large number of haemo-cultures were made from 14 cases studied over a period of two months during the course of the disease. Blood from the jugular vein was thus incubated under aerobic and anaerobic conditions. Ten per cent. of these became accidentally contaminated; 50 per cent. were sterile, the rest, that is to say, 40 per cent. revealed a coccus generally in the form of diplococci and Gram-positive. This organism grows readily, even under anaerobic conditions, on the ordinary culture media and rapidly produces a uniform thin silky-looking film with no special odour. The author does not believe that this organism is responsible for the onset of the disease inasmuch as (1) inoculation into common laboratory animals and healthy lambs failed to reveal any pathogenicity, (2) control

experiments showed that an organism identical in appearance could be isolated from healthy lambs living in regions not affected with *renguera*, and these lambs, in which the organism was discoverable, remained healthy for a long period afterwards at the laboratory.

In six cases of the disease examined immediately after death the blood of four gave cultures of the diplococcus and two remained sterile, while similar results were obtained on sowing out the cerebro-spinal fluid. Inoculation of media with the pulp of the enlarged lymphatic glands always gave negative results.

According to the author repeated attempts at transmitting the disease artificially in various ways gave constantly negative results. The author then briefly summarises some of his experiments dealing with the attempted transmission of the disease by cohabitation and inoculation of material suspected to be virulent. In the cohabitation experiments in addition to healthy lambs pregnant ewes were placed with the affected animals in order to determine whether the infection takes place during foetal life. In two experiments transmission by means of ecto-parasites was attempted by placing sheep keds, gathered from affected lambs, on healthy lambs.

In his conclusions the author states that this paraplegia of lambs reminds one very strongly of infantile paralysis in its endemic form and suggests the probability of its being caused by an ultravisible virus. The only prophylactic measures at present possible are isolation of infected flocks, immediate slaughter of all affected animals, and a change of pasture from low marshy districts to higher, dry regions.

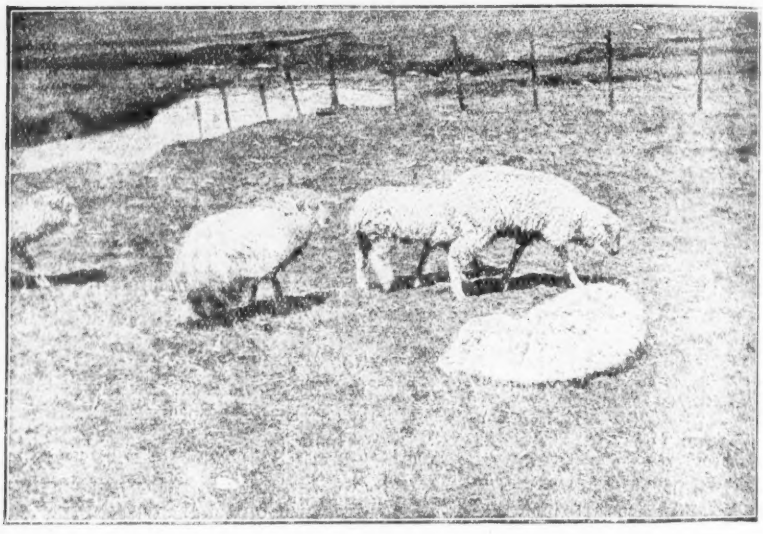
GAIGER (S. H.). **Renguera: A Paralytic Sheep Disease in Peru.**—*Jl. Comp. Path. & Therap.* 1917. Sept. Vol. 30. Pt. 3. pp. 185–209. With 4 text figs.

This paper contains an account of the work done by Gaiger during a visit to Peru in the latter half of 1916 with the object of investigating the disease already discussed in the preceding extract. The work was conducted on behalf of a number of sheep farmers who were suffering very considerable economic losses owing to the large mortality amongst their lambs each year. The laboratory material necessary was taken out from England. Gaiger first gives a good description of the peculiar local geographic and climatic conditions prevailing in Peru together with the sheep-farming customs. The native sheep, which are of a very poor type, are now being improved by crossing, mostly with the Romney Marsh breed. The small laboratory was fitted up on a large sheep farm—Atocsaico Farm, owned by a British company. This farm was situated at an altitude of 14,000 feet and lay on rolling grass country, the Home Farm being situated in a valley on the banks of a small stream.

A brief description is given of the history of the disease. The word *renguera* is said to be probably derived from the Spanish word *rengna* meaning "injured in the back," and Gaiger remarks that there is a complete absence of any reliable information about the origin and spread of the disease, and does not discuss the probable source of its introduction. Owing to the confusion in the classification of sheep

diseases the word *renguera* has come to be used in the case of nearly every sick lamb and the losses attributed to it are said to have been grossly exaggerated, although at the same time the disease itself undoubtedly causes very considerable losses.

The disease had been known at Atocsaico for six years. At first the cases were few in number but they became doubled each successive year until in 1915 they amounted to about 700 out of 5,000 lambs born. On neighbouring farms the losses were very much greater and also increasing every year in importance, one farmer stating that he had lost every lamb in 1915 from the disease. The disease was probably first noticed in Peru about 15 years ago. It is stated to occur only in sheep but it was also reported to affect young llamas;



* Fig. 3.

These hoggets were being driven to the right when photographed. In falling they nearly always swing half round and fall facing the opposite direction to that in which they were walking. One is seen with its hind quarters collapsing.

cattle and horses are not susceptible. Symptoms commence in lambs from the age of about 11 days and fresh cases keep on occurring up to the age of 5 to 6 months. The description of the symptoms is similar to that given by TABUSSO. A not uncommon symptom in bad cases in lambs is slight up and down trembling of the head and more rarely this symptom extends to the whole body, which shivers as though from cold: a peculiar symptom in these cases is a frequent grinding of the teeth, making a noise which can be heard 10 or 20 yards away. Clinically, renguera is a disease of the nervous system and resembles an intoxication by some poison working on that system.

In 1915 the author believes that a mortality of 8 or 9 per cent. on Atocsaico Farm was caused by the disease, but, owing to the inclusion

* [Reproduced by permission from the *Journal of Comparative Pathology and Therapeutics.*]

of a number of other diseases under the same name the losses were estimated by the farmers to be much higher. Gaiger, also, notes that it is doubtful whether *renguera* of itself would account for many deaths; the cause of death in most cases is inanition produced by the inability to obtain nourishment on account of the paralytic symptoms. In 1916 the mortality was high owing to the prolonged dry season and the lambs were born long before the grass began to grow. It is denied that the mortality is increased by cold and damp for, in 1916, it was exceptionally dry and *renguera* commenced sooner and in younger lambs than ever before.

Owing to the very rapid onset of putrefaction after death it was decided to attach no importance to post-mortem examinations of animals which had died a natural death; even in apparently healthy lambs Gaiger showed that there may be an invasion, especially with the *Bacillus coli*, from the bowels. The lesions discoverable in the more severe cases in young lambs are said to be as follows: (1) increase in the peritoneal, pericardial, and pleural fluids, these being frequently slightly tinged with haemoglobin; (2) a darker colour of the liver in most cases; (3) slight, but never marked, increase in the colouring of the meninges of the brain and spinal cord; (4) occasional catarrhal condition of the small intestine in lambs; and (5) a not infrequent patchy endocarditis.

The disease is compared with other important non-inoculable sheep diseases whose etiology is unknown, viz., louping-ill, scrapie or lumbar prurigo, and swingback in the British Isles, and *patadeta* in Patagonia. Neither scrapie nor louping-ill exist in Peru but both *renguera* and louping-ill probably exist in Patagonia and are confused together under the name of *patadeta*. The clinical symptoms of *renguera* in its most chronic form are indistinguishable from those of swingback in England, and it may be more than a coincidence that *renguera* has appeared in a part of the world where considerable numbers of Romney Marsh sheep have been imported. It is possible to produce symptoms similar to those of *renguera* by injuring the spinal cord with a fine syringe needle at the seat of lumbar puncture but these symptoms only last for a short while. The absence of ticks removed one factor which would have had to be studied as a possible cause, knowing what one does of the action of *Ixodes pilosus* in Cape Colony and *Dermacentor venustus* in British Columbia in producing paralysis in sheep.

No organisms were discoverable in smears from the blood or any of the other tissues or fluids of the body by direct microscopic examination.

The following were the gross parasites found commonly affecting sheep and lambs:—

(1) *Fasciola hepatica*, very common in the liver of practically every sheep examined. They were to be found in lambs from about two months old.

(2) *Dictyocaulus filaria*. Was very common but never in very great numbers. It was also common in the hoggets and found in lambs over two months old.

(3) *Trichocephalus affinis*. Is perhaps the commonest parasite with which sheep are affected, and is present in greater numbers than any other worm. Found in lambs from about 3 weeks old.

(4) *Oesophagostomum radiatum.* Was frequently found but usually in very small numbers.

(5) *Monieza expansa.* Was sometimes present in adult sheep.

(6) *Cysticercus tenuicollis.* Was very frequently present in the mesentery of hoggets and adults.

(7) *Haemonchus contortus.* Was sometimes seen but rarely present in numbers over six or eight in one animal.

None of the above parasites could be blamed for producing such symptoms as those of *renguera*; they were to be found equally numerous in *renguera* animals and apparently healthy animals. Also, neither chemical poisons nor poisonous plants could be blamed and no protozoan infection was discoverable.

The author then gives details of a number of experiments carried out with a view to attempting to transmit the disease artificially. Inoculation experiments with brain, blood, cerebro-spinal fluid, peritoneal fluid, and pericardial fluid all failed to set up any symptoms and feeding experiments likewise remained negative. "Inoculation and feeding experiments having failed to transmit the disease it seemed unnecessary in the absence of ticks to resort to cohabitation experiments to see if the disease could be transmitted in this way."

Gaiger then details a large number of cultural experiments which demonstrated the almost constant association of a micrococcus with the disease. These were performed with great care and under difficulties owing to the low boiling point of water at the high altitude of the sheep farm. The technique adopted in obtaining cerebro-spinal fluid is described. Amongst the cases in the *sierra* the coccus was thus found by cultural experiments to be present in the peritoneal fluid in 30 out of 43, pleural fluid in 4 out of 14, pericardial fluid in 5 out of 14, liver in 11 out of 30, gall bladder in 1 case out of 1, blood in 5 out of 25, central nervous system in 10 out of 38, and brain in 1 out of 5 cases in which it was examined. The coccus is stated to have also been found in cases subsequently examined by Tabusso in his laboratory at the Agricultural College in Lima. Inoculation experiments with this coccus were made into ten lambs and two rabbits intraperitoneally, intra-spinally, by injection into the nasal cavities, or by feeding, with negative results.

An attempt was made to find the coccus in young healthy lambs on Atocsaico. Five were examined and the coccus was found in two in the peritoneal fluid and in one of these two it was also present in the blood. In the other three healthy lambs the coccus did not grow from any of the fluids or tissues of the body but in one case *Bacillus coli* grew from the peritoneal fluid.

Large doses of culture of the coccus failed to set up the disease and so the author made an attempt to find out whether the symptoms might not be caused by the manufacture of a toxin. Peritoneal fluid from a renguera case was pipetted off into a culture tube and incubated for seven days; 1 c.c. of this fluid inoculated intra-spinally into a lamb produced no apparent ill-effect.

The role of this coccus in the evolution of the disease cannot be determined until one is able to transmit the disease experimentally from infected to healthy animals. The serum of infected animals showed no agglutinative properties for an emulsion of the coccus. With regard to the cultural characters of this coccus the author found

that it was sometimes difficult to obtain a first growth from the body fluids. A visible growth was often only obtained after incubation at body temperature for several days. Egg medium was sometimes successful in obtaining a primary growth when other media failed. Sub-cultures grew readily on all ordinary media. There was no growth on gelatin at 20° C.; in broth the organism produced a turbidity which then settled as a distinct deposit to the bottom of the tube. On agar the growth was a clear shining semi-transparent film without colour. On solid media the first growths from the body were sometimes isolated colonies of which there might be five or six scattered over the surface, but more frequently the growth originated in the water of condensation in the bottom of the tube. The coccus prefers a medium slightly alkaline and will not grow on an acid medium. It is preferably an aerobe but grows fairly well under anaerobic conditions. It produces acid and does not ferment glucose or lactose.

The paper concludes with a discussion of the measures that can be adopted to eradicate the disease. Curative measures hold out little promise of success. In judging the efficiency of preventive measures care must be taken to avoid falling into error as very little has ever been done on the sheep farm in the way of keeping proper statistics. The author's view is that the rise and fall of the disease is solely due to the age of the lambs and that the wet or dry seasons do not exert any distinctive influence except as regards their exceptional severity. Experiments in altering the breeding season are about to be made on Atocsaico to see whether the losses from frosts and starvation will be reduced by having the lambs born in April instead of September and it will be instructive to learn whether *renguera* occurs when the April lambs are a week old or not. Also, experiments are to be made to show the effect of breeding from some of the least affected or "recovered" hoggets and the number of cases which occur among the resulting lambs. Further experiments are to be made to determine the preventive value of inoculation of a serum immune against the coccus into young lambs. All lambs are to be destroyed and buried as soon as they become infected. On one farm it was believed that feeding with a mixture of salt and sulphur produced beneficial results.

(c) Equine Pneumonia.

Watkins-Pitchford (H.). **An Enquiry into the Horse Disease known as Septic or Contagious Pneumonia.**—*Vet. Jl.* 1917. Oct. Vol. 73. No. 10. pp. 345–362. With 6 text figs.

Although the disease above referred to is by no means what is commonly regarded as a tropical disease, it is felt that the subject is of such world-wide veterinary importance and has in the past presented one of the most difficult tasks confronting the investigator into the nature of animal diseases that a brief extract and review of this attempt to solve the problem would not be out of place in this *Bulletin*.

The work undertaken by Watkins-Pitchford was apparently performed by direction of the administrative authorities of the British Army Veterinary Service and the clinical material necessary for the study was afforded by the Swaythling Remount Depot and Veterinary Hospital. The investigation covered a period of eight months, a

considerable part of the time being taken up with other duties. It seems unfortunate that research work on a disease which has caused very considerable economic losses among British Army horses should be allotted so small an amount of trained personnel and time.

At the commencement of the report the writer apologises for attempting to construct a "theory upon hazardously meagre data," but then lays down a series of elaborate hypotheses and conclusions in fifty-two numbered paragraphs, at the end of which (para. 52) he "again regrets the hasty and immature nature of the work."

No reference is made to the work of former investigators on the subject and in reality although the author confesses (para. 45) that "he has no adequate works of reference at hand" the style of writing and nature of the argument put forth would strike even the most casual reader with the fact that the large amount of work already done on this difficult question has either been insufficiently consulted or not read at all.

In a brief report furnished in September 1915 the author stated "that no evidence was then forthcoming as to the directly infectious nature of the disease from horse to horse, and the report further aimed at demonstrating the existence of a lengthy and indefinite period of incubation or latency existing between infection and obvious lung involvement."

The same opinion is held in the present report, as can be seen from the following two paragraphs :—

7. "The name of 'Specific' or 'Contagious' Pneumonia, both of which terms are frequently applied to the disease, appear to the writer as misnomers, and there also seems evidence leading to the conclusion that the term 'Septic' is equally inapt as a description of the disease if used in a specific sense.

8. "Recent observations, indeed, suggest the classification of the disease as one of an idiopathic rather than a specific nature, or, perhaps, a standing midway between the two categories, being due to the agency of an organism occasionally present in, but non-pathogenic to, the normal horse, and assuming a pathogenic phase under conditions of lowered vitality in the host which harbours it."

Again in para. 29 a brief summary is given of the theories advanced in the foregoing paragraphs :—

"(a) The great majority of cases of 'specific' pneumonia are preceded by an involvement of the nasal membrane constituting the condition known as 'catarrh.'

"(b) Such antecedent condition of catarrh is induced by depleting physical conditions and not by direct transference of infection from horse to horse.

"(c) Throughout the clinical course of such cases a specific organism is present probably in all, but certainly in the majority of instances, both in the circulating blood and in tissues after death.

"(d) The blood of animals suffering or recovered from either of these diseases acquires a specific property capable of clumping or agglutinating strongly the bacillus in question.

"The conclusion drawn is that an essential connection exists between the ordinary catarrhal and pneumonic attack and the organism which later although usually non-pathogenic to the normal horse, is capable, in circumstances of lowered vitality, of establishing a pathogenic action ultimately leading to grave tissue involvement. . . ."

The organism referred to above and styled the bacillus "*x*" is stated to resemble closely *B. subtilis*, an organism which is usually regarded as being non-pathogenic. The author, however, claims that there are "certain points of difference in morphology and culture"

between these two organisms and details regarding the biological characters of the incriminated organism are promised in a later report. This organism was found in pure culture in "57 per cent. of cases in the circulation of the living animal when suffering from catarrh" . . . "in the sporing condition as well as in the resting stage." [No sign of sporulation is visible in the organisms depicted in photo-micrograph 1 and stated to be in the sporing condition.—Ed.] The organism was also generally found in pure culture in the pleural membrane and sublying exudate on the surface of the lung in cases which had apparently not reached the so-called septic stage. "Even in the advanced septic stage the bacillus, which appears to be the primary causal organism, can be isolated without difficulty owing to its great resistance to a degree of temperature which kills the other organisms."

"This same organism is present occasionally in the circulating blood of horses not the subject of any catarrhal condition and apparently in normal health," but it is believed that the normal circulating blood does not harbour it indefinitely and that its presence in such cases must be looked upon as a pathogenic phenomenon; animals harbouring this organism are regarded as disease carriers.

The organism presented a striking peculiarity in that it could only be isolated in culture when horse flesh or serum, instead of the usual beef products, was used in the preparation of media.

"The presence of agglutinins in the blood of the horse suffering from, or recovered from, catarrh is demonstrable to a marked degree" and "the agglutinative principle is absent from young equines or only present to a modified degree." [We wonder what the significance of a modified degree of agglutinative principle can be.—Ed.] "That this agglutinative power is not entirely dependent on previous catarrhal attack, however, would seem probable from the agglutination of the normal ox and sheep, which although not high, is distinctly present. Such differences between the horse and the ox would appear likely to be due to the presence in the tissues of the former of some substance of a bio-chemical nature, permitting the more vigorous development of the organism in question." [A very comprehensive although extremely vague statement.—Ed.]

In giving a brief sketch of what he considers the pathological and clinical picture of the disease the author states *inter alia* (para. 41) "congestion of the lung tissue . . . is attended with embolism and occlusion, and by the lodgment of the organism in the ultimate air passages where the optinum conditions of warmth, stillness, and an adequate supply of oxygen ensures its vigorous proliferation. . . ." However, earlier on (para. 35), in discussing the pathology of the so-called "septic" condition he states that this appears always to be of the nature of a secondary invasion due to "a septic environment such as most stabled horses are liable to. Recognition of this fact obviously furnishes the *rationale* underlying open air treatment of pneumonia where an increased opportunity for oxygenation and freedom from septic environment often prevents the grave condition which ensues in cases where the tissue of the lung becomes septic." [Oxygenation is thus both a markedly deletereous and a beneficial process in that it on the one hand stimulates the growth of the alleged causal organism and on the other hand inhibits a "septic" condition.—Ed.]

The author deals finally with the transmission of the disease and his experience leads him to state that "transference by contact, both of pneumonia and the ordinary form of catarrh, appears to fail. Moreover, "the lighter class of horse possesses a considerable degree of immunity as compared with the heavy draught type."

[In this connection more especially it is unfortunate that the protocols of the experiments do not accompany the text inasmuch as they were omitted by the Editor of the journal in which the report is published as they were too voluminous for reproduction. They would in reality have been of fundamental value in judging the merits of the work. It is obvious that the author attempted to carry out his experiments in about the worst possible circumstances. The animals which passed through his hands necessarily possessed no history regarding previous infection and no knowledge could possibly have been obtained regarding their previous history of freedom from infection or infective environment. Satisfactory work could only have been done if such knowledge had been obtainable and proper facilities for isolation and careful observation had been furnished on a scale far more extensive than is obtainable at an ordinary laboratory.—ED.]

REPORTS.

GOLD COAST. **Report of the Accra Laboratory for the Year 1916.** J. W. Scott MACFIE, Pathologist. 115 pp. London: J. & A. Churchill. (pp. 23–28.)

Examinations of Various Animals.

"The routine blood examinations of the animals brought to the slaughter-houses was discontinued in 1916, owing to the reduction of the Staff occasioned by the continuation of the war. No returns have therefore been made of the parasitic infections occurring in the animals slaughtered at Accra; but as this subject was thoroughly investigated in 1915 the omission was a welcome one, because the time that would have been spent over the examinations was able to be devoted to other work.

"Various animals, however, have been examined at the laboratory during the year, namely, 14 antelope, 3 bats, 19 birds, 12 cats, 5 cattle, 16 dogs, 2 fish, 1 frog, 4 goats, 1 hare, 2 hedgehogs, 18 horses and mules, 4 hyaenas, 1 leech, 1 lizard, 3 pigs, 36 rats, 3 sheep, 10 snails, 5 snakes, 11 toads, and 2 wart-hogs: 173 animals in all. No parasites were found in the blood of the bats, cats, fish, frogs, goats, hare, hedgehogs, hyaenas, leech, lizard, pigs, sheep, and wart-hogs.

"A large number of intestinal worms and other parasites were collected from these animals, but these are not referred to below, as no attempt has yet been made to identify them. A considerable number of other animals were also examined for intestinal spirochaetes.

Antelope.

"The 14 antelope examined were five duiker, three hartebeestes, two oribi, one reedbuck, two roan, and one water-buck. Eleven of the specimens were blood films sent by Dr. J. J. Simpson from Yapi, and one a blood film sent by Dr. Allan from Gambaga. Parasites were found in three, namely, a hartebeeste, an oribi, and a reedbuck, all from Dr. Simpson.

"In the blood of the hartebeeste (*Bubalis major*) a few small piroplasms were found which exactly resembled the organisms so common in cattle

in West Africa and which are generally known as *Theileria mutans*. Only ring forms were found. In the blood of the oribi an exactly similar infection was found. No Koch's 'blue bodies' were seen in either animal.

"An apparently similar parasite was found by Todd and Wolbach in a roan antelope in the Gambia ('Jl. of Med. Research,' 1912, Vol. 26, p. 195), and the name *Theileria hippotragi* was proposed for this species. The organisms found in the blood of the hartebeeste and oribi referred to above did not differ in any particular from those commonly seen in cattle in the Gold Coast, and as they may have been the same parasite it seems unnecessary to distinguish them by special names.

"A few trypanosomes were found in the blood of the reedbuck. These were polymorphic organisms, and may have been either *T. pecaudi*, the common cattle species, or *T. gambiense*, the human parasite. No forms were found with posteriorly placed nuclei, but this does not really assist in the identification, as such forms, which occur in *T. pecaudi* but not in *T. gambiense*, are very rarely found except after inoculations into the small laboratory animals, such as rats or guinea-pigs.

Birds.

"The 19 birds examined included four swallows, two pigeons, one guinea-fowl, nine domestic fowls, one sparrow, and two other small birds. The only infections found were in the sparrow and the domestic fowls.

"The single sparrow examined was found to be heavily infected with an endoglobular parasite, probably *Haemoproteus danilewski*.

"Spirochaetes, *S. marchouxi*, were found in the blood of seven out of the nine domestic fowls sent for examination.

Cattle.

"A very interesting piroplasm was found in blood films from a cow sent to the laboratory by Dr. E. W. Graham from Tamale, but as this parasite is still under investigation an account of it will have to be deferred.

Dogs.

"Two of the dogs examined were infected with *Babesia canis*, and one of them, a rough-haired terrier, was kept under observation for some weeks and was treated with trypanblau with good results. This dog when first seen was completely paralysed in its hind legs. Under treatment this gradually passed off, but it remained well marked long after all parasites had disappeared from the blood.

"Polymorphic trypanosomes were found in one dog. The animal was said to be very lethargic and always sleeping, he appeared to be unable to recognise familiar voices, he had to be moved forcibly from place to place, and when roused he stood with his legs widely separated. The parasites were probably *T. pecaudi*, but as no posterior nuclear forms were found, and in the absence of inoculation experiments, it is possible that they may have been *T. gambiense*.

"Sheathless filarial embryos were found in one dog.

"Ten dogs were dissected during the year. One animal, which had been found in a moribund condition, had an intussusception of the small intestine. The invaginated part of the gut was gangrenous, and immediately below the site of the intussusception there were innumerable small tapeworms. In another dog, which had been shot because it appeared to be in great pain, the appendix was found to be twisted like a corkscrew and inflamed.

Ankylostomiasis of Dogs.

"In 1915 Yorke and Blacklock recorded the occurrence of *Ancylostoma caninum* and *A. ceylanicum* in dogs at Freetown, Sierra Leone, an infection which they found to be present in all the seven animals they examined ('Annals of Trop. Med. and Parasitol.,' Vol. 9. p. 425). This observation, interesting enough in itself as it is, has a special bearing on human pathology, because one of the parasites, *A. ceylanicum*, has been found in other parts of the world (India, Siam) in the intestine of man.

"The ten dogs dissected at Accra in 1916 were therefore examined carefully for ankylostomes, and four of them were found to be infected.

In each case the species found was *A. ceylanicum*. The dogs at Accra appeared therefore to be less commonly infected with ankylostomes than those at Freetown, and in the ten individuals examined *A. caninum* was not identified.

"Leiper ('Jl. R. Army Med. Corps,' Vol. 24, p. 569) has suggested that Yorke and Blacklock were mistaken in their identification of *A. ceylanicum*, and that they were really dealing with *Uncinaria stenocephala*, a similar ankylostome often found in association with *A. caninum*. The buccal cavity of *Uncinaria stenocephala* is furnished with cutting plates but no teeth, and the dorsal ray ends in three deep digitations, so that a confusion between the two parasites would appear to be almost impossible, and the figures which illustrate the paper by Yorke and Blacklock seem to justify their identification.

"The specimens of *A. ceylanicum* collected at Accra conformed to the description of Yorke and Blacklock and of Lane ('Ind. Jour. Med. Research,' Vol. 4, p. 74), which referred to parasites from Sierra Leone and India respectively. I have been permitted by Professor Stephens to examine some examples of *A. ceylanicum* sent from India by Major Clayton Lane, and have found that they closely resembled those brought from Accra, but appeared to have a narrower dorsal ray. The dorsal rays, however, terminated in three digitations, and not in two, as figured by Leiper.

"In the small number of dogs dissected at Accra, *A. caninum* was not found. Some ankylostomes collected from dogs at Lagos and sent to Professor Stephens in 1913 were identified as *A. caninum*, and recently on re-examining these materials no specimens of *A. ceylanicum* were found. It would be interesting to ascertain by further dissections if *A. caninum* occurs at Accra and *A. ceylanicum* at Lagos.

"One of the dogs found to harbour *A. ceylanicum* had been kept at the laboratory since it was a puppy—that is, for about a year. On 21st January he was noticed to be getting very thin and lethargic, and his blood was therefore examined, but no parasites could be found and no auto-agglutination of the red corpuscles such as occurs in trypanosomiasis. It was noted on this occasion that no eosinophile leucocytes were seen. On 1st February he was again examined, as he was getting worse and was very anaemic. No blood parasites were found. From this time the dog rapidly wasted, and died on 9th February. Blood taken just before death showed no parasites, no eosinophile leucocytes were seen, and a differential leucocyte count (500) gave the following result:—

Polymorphonuclears	84·2 per cent.
Mononuclear cells	15·6 „ „
Eosinophiles	0·0 „ „
Basophiles	0·2 „ „

"On dissection the tissues were found to be very pale, indicating an advanced condition of anaemia, but no gross lesions were found. Both the liver and spleen were enlarged, but smears showed no parasites. Three tapeworms, one *Ascaris*, and a large number of ankylostomes were found in the intestine.

"This case would seem to prove that ankylostomiasis may be a serious disease in dogs, although no doubt, as in man, the parasites may sometimes be present without producing appreciable symptoms of illness.

"As has already been stated, *A. ceylanicum* has not yet been found as a human parasite at Accra, but very few examinations have as yet been made, and the question requires further investigation.

Horses and Mules.

"Trypanosomes were found in two of the horses examined, namely, *T. vivax* in one and *T. congolense* in the other. Neither of the infections occurred at Accra, the blood film from the first having been sent to the laboratory from Gambaga by Dr. Allan, and that from the second from Yapi by Dr. Simpson.

"One mule examined at Accra by Dr. Ingram in December was infected with a polymorphic trypanosome, probably *T. pecaudi*.

Rats.

"Most of the rats examined (32) were Black Rats (*Epimys rattus*) sent to the laboratory by the Medical Officer of Health but in addition one Pouched Rat (*Cricetomys gambianus*) was examined and three field rats with white bellies and reddish sides of an undetermined species. All the animals were captured at Accra.

"Grahamella bodies were found in eleven of the Black Rats, the Pouched Rat, and two of the field rats. A Bass culture was made with the heart blood of one Black Rat showing these bodies. No increase in the number of bodies was observed, but after 24 hours in some of the cells they were seen to be collected at one side. The bodies were still recognisable on the fourth day, when the experiment was discontinued.

"*Trypanosoma lewisi* was found in six of the Black Rats, and the piroplasm, *N. decumani*, in four Black Rats and two field rats.

"A mite disease to which the experimental white rats were subject is described elsewhere.

Snakes.

"Haemogregarines were found in the blood of two of the five snakes examined, and Dr. Ingram found a *Haemacystidum* in another specimen.

"In addition to these specimens some very interesting materials have been received from Dr. J. E. L. Johnston (Northern Nigeria) and Dr. Corson (Lorha), which unfortunately it has not yet been possible to study. The materials consisted of blood films from snakes showing inclusions in the red corpuscles similar to those which occur in toads, figures of which were given in the Laboratory Report for 1914 (Plate I, figs. 60–62) These bodies are without doubt the same as the 'unidentified Parasite' found by Dutton, Todd, and Tobey ('Annals of Trop. Med. & Parasitol.,' Vol. 1, 1907, p. 287) in a puff-adder caught in the Gambia and in frogs and toads caught in either the Gambia or the Congo, and the same as those found by França in toads from Portuguese Guinea, which he has described under the name *Toddia buffonis* ('Archiv. do Inst. Bacter. Camara Pestana,' III, Fasc. II, p. 229).

"Dr. Johnston's materials also showed a pigmented intra-corpuscular parasite of considerable interest, and a trypanosome.

Toads.

"Eleven specimens of the common toad (*Bufo regularis*) were examined, all in January, but no new parasites were found. Eight of the toads harboured the usual large haemogregarine, and four *T. rotatorium*, a single examination only being made in each case. Three of the animals showed the inclusions referred to above as *Toddia buffonis*."

ASSAM. **Report of the Civil Veterinary Department for the Year 1916-1917.** [HARRIS (W.)]—19 pp. f'cap. With 8 tables. 1917. Shillong: Assam Secretariat Printing Office.

A considerable part of this report is taken up with details regarding general administration and veterinary instruction of Government stipendiaries at the College.

The number of deaths from contagious diseases reported in the various Provinces during the year 1916–1917 was as follows:—

Equines—glanders 2, anthrax 42, surra 26, dourine nil, other contagious diseases 192. Bovines—rinderpest 20,817, foot-and-mouth disease 5,737, haemorrhagic septicaemia 4,245, blackquarter 241, anthrax 1,839, other contagious diseases 12,073. Other animals—rinderpest 498, foot-and-mouth disease 617, haemorrhagic septicaemia 459, blackquarter 61, anthrax 76, distemper 160, rabies 49, other contagious diseases 798.

During the year preventive inoculations by the "serum alone" method were carried out against rinderpest, anthrax, and haemorrhagic septicaemia. The number of inoculations compared with those of the

preceding year shows a decrease which is due partly to the smaller number of outbreaks reported and to the reduction in the number of veterinary assistants.

Rinderpest.—Inoculation was carried out in 348 outbreaks in 19 divisions. In these outbreaks 9,633 animals died before inoculation; 29,986 animals were inoculated, of which 571 animals died after inoculation.

Anthrax.—67 outbreaks of suspected anthrax were reported and the disease was definitely diagnosed by microscopic examination in 59 outbreaks. Inoculation was carried out in 47 outbreaks; in these outbreaks 471 animals died before inoculation and 3,814 animals were inoculated, of which 6 died subsequently of the disease.

Haemorrhagic Septicaemia.—Specimens were received from 20 suspected outbreaks and the diagnosis was confirmed by microscopic examination in 16 of these. Inoculation was undertaken in 13 outbreaks; in these outbreaks 80 animals died before inoculation and 2,216 animals were inoculated, of which 1 subsequently died.

Dr. MACALISTER, Imperial Pathologist, Muktesar, visited the country during the year for the purpose of investigating a disease in horses known as *kumri*. This disease attacks and renders useless a considerable number of valuable horses every year and is found in every district. A number of horses were provided for purposes of investigation; MACALISTER'S report has not been published. The numerous tables contain a mass of statistics regarding the prevalence of contagious diseases in the various Provinces and the administration of the Civil Veterinary Department.

BIHAR and ORISSA. **Annual Report of the Civil Veterinary Department for the Year 1916-1917.** [QUINLAN (D.), Superintendent.]—pp. 3–8. Patna: Superintendent Government Printing. Bihar and Orissa.

In this report Quinlan gives an account of a very considerable amount of field work performed by a native subordinate veterinary staff under his active supervision. This work was carried out under considerable difficulties owing to the great shortage of assistants and the opposition of the native cattle owners to inoculation and supplying information with regard to outbreaks of disease in their herds. The subordinate staff of the Civil Veterinary Department at the close of the year consisted of seven inspectors and 70 veterinary assistants, but it is hoped that a sufficient number of assistants may be forthcoming when the students from Bihar and Orissa admitted into the Bengal Veterinary College have completed their training. The number of animals treated at veterinary hospitals was 28,180, as against 26,213 in the previous year; the number treated by itinerant veterinary assistants was 55,311 as against 54,904 the previous year. The following is briefly an account of the diseases reported in the Province:—

Equines.—Two outbreaks of glanders occurred, one at Hazaribagh involving 19 cases and another at Angul, Orissa, in which 2 cases were definitely diagnosed. Fifteen deaths from surra were reported from Singhbhum. No details are available regarding other contagious diseases which caused mortality.

Bovines.—As in previous years rinderpest and haemorrhagic septicaemia were the chief causes of cattle mortality. The former was responsible for 19,144 and the latter for 5,584 out of the 26,107 deaths from contagious diseases of all kinds reported during the year. Rinderpest appeared in most of the districts of the Province, the number of outbreaks reported being 1,829, of which about half were attended to by veterinary assistants. 896 outbreaks of haemorrhagic septicaemia causing 5,584 deaths out of 7,330 animals attacked, were brought to the notice of the staff; again only about half of these outbreaks could be attended to.

Foot-and-mouth disease was responsible for 1,748 outbreaks, the number of animals affected being 39,740, out of which only 838 were reported to have died. This disease is regarded as unimportant as it does not of itself usually cause very great mortality unless complications set in.

Blackquarter occurred in 6 districts and affected 166 cattle in 12 outbreaks; there were 164 deaths. 128 deaths from anthrax out of 144 animals attacked were reported from 9 districts. 205 deaths from other contagious diseases are reported but no details are available as to the cause.

Details are given with regard to the inoculation work carried out. The scheme for inoculating cattle through the agency of a special staff of locally trained inoculators, which was introduced as an experiment in 1913, was in force throughout the year in the Ranchi district and, though the number of inoculations for both haemorrhagic septicaemia and rinderpest shows a falling off in some parts of the district, a considerable measure of success was obtained where the missionaries took an active interest in the work of the inoculators. The following table summarises the results of preventive inoculation during the year.

Name of disease.	Method of inoculation.	Number of outbreaks in which inoculation under-taken.	Number of animals which died uninoculated in course of outbreaks.	Number of animals inoculated.	Number of inoculated animals which died of the disease.
Rinderpest .	Serum alone	636	6,689	66,423	288
Haemorrhagic	(a) Serum	141	823	16,521	51
septicaemia.	(b) Vaccine	38	149	4,205	13
Anthrax .	Serum	13	42	1,759	2
Blackquarter.	Vaccine	2	1	210	Nil

In addition 8,982 animals were inoculated against rinderpest and 20,688 against haemorrhagic septicaemia under the Ranchi inoculation scheme.

British East Africa. Department of Agriculture. Annual Report of the Veterinary Department for the Year ending 31st March 1916. [Stordy (R. J.), Chief Veterinary Officer.]—pp. 62–71. Nairobi and Mombasa: Printed at The "Leader."

This report of the Chief Veterinary Officer first gives details regarding the constitution and duties of the staff of the Veterinary

Department during the year 1915–1916. The remainder of the report contains a mass of experience which cannot be extracted with justice and is reprinted as follows:—

"*Disease of Cattle.*—East Coast Fever.—Fresh outbreaks of East Coast Fever have occurred on several farms on the Uasin Gishu Plateau. A Veterinary survey was carried out there, in July and August, 1915, and it was found that, owing to the shortage of immune transport oxen caused by the Military requirements having demanded the purchase of this type of animal, it was impossible to enforce strict quarantine measures as it was necessary, to avoid grave hardship, to maintain transport in the district. There are a good number of dipping tanks already erected on the Plateau, and more are being built, so that it is hoped that it will soon be possible for all animals on the Plateau to be regularly dipped.

"Since the War began, there is evidence that East Coast Fever has spread in the settled areas, and in many cases this can only be attributed to the illicit movement of cattle from infected native reserves, such movement having been stimulated by the shortage of work oxen caused by the War.

"As a result of the heavy mortality recorded amongst cattle drawn from native reserves, collected at various military supply centres, it is evident that in the so-called infected reserves there must be large areas where the disease is non-existent. This only emphasizes the necessity for erecting dipping tanks in these reserves, to check the spread of the disease, and to safeguard the clean herds.

"During the year Government dipping tanks have been completed at Nairobi, and at Rumuruti, and a tank has been erected by the Military Authorities at Fort Ternan. Several private dipping tanks have also been erected, and some 80 are now in use in the Protectorate.

"It has been noticed on several farms where 'redlegged' ticks are prevalent, that those situated inside the ears frequently survive an immersion in the dipping fluid, and the attention of stock owners is drawn to the necessity for frequently dressing the inside of the ears of cattle infested with these ticks with a mixture of lard and Stockholm tar, in order to get rid of them.

"When dipping operations are commenced on heavily infected farms in this country it has been found that a considerable mortality occurs amongst susceptible stock during the first year. This experience is similar to what has been found to occur in Rhodesia, and differs from that of stock owners in South Africa.

"The number of cattle, the property of Settlers, admitted to the East Coast Fever Testing Area at Kamiti during the year was 587. The number of deaths was 24.

"Seventeen adult oxen drawn from the Uasin Gishu Masai Reserve were tested during the year, and all of them proved to be resistant to the disease.

"The following extract from the Government Analyst's report is of considerable interest:—

"During the year 1915, the number of samples of cattle dip analysed and reported upon was 650 against 480 in 1914. The results show no improvement upon those of the previous year as will be seen from the following table.

Percentage Error.	Percentage of Samples.	
	1914.	1915.
0—10	61·4	54·5
11—20	20·6	25·7
21—30	9·2	10·3
31—40	4·0	3·8
41—50	1·5	2·6
Greater than 50	3·3	3·1
Sufficiently correct	61·4	54·5
Dangerously incorrect	18·0	19·8

"It was anticipated that, with more experience, the dip owners would improve upon their record of 1914 in the matter of maintaining their dips approximately correct, but it is apparent from the above comparison that in reality there has been a slight falling off in the skill displayed. Probably the fact that many of the Settlers have left their farms in order to do Military service is quite sufficient explanation and, from this point of view, it is satisfactory that the results are so near to those of the previous year.

"The analytical control of numerous cattle dips in the country has not yet resolved itself into a system. It has been left to the discretion of the owner, how frequently he shall have an analysis made, so that it has happened that whereas some owners have only once or twice submitted samples for analysis others again have sent in up to 32 samples in the year.

"It sufficiently appears from the preceding classification of samples according to the magnitude of their error in strength that considerable improvement should be made in the direction of maintaining dips in a state of efficiency. It is very obvious, from a consideration of the record of individual dips, that the owners are frequently working in the dark as to the capacity of the dip and hence cannot make necessary corrections when they have been informed of their error. The consequence of this is that they immediately send a fresh sample in order to ascertain how far their attempt at correction has succeeded.

"The analysis of arsenical dips costs time and money, and this method of obtaining analysis after every correction, instead of relying upon exact calculations of volume of the dip and accurate measurement of the material added, is taking a grossly unfair advantage of the privilege of free analysis which has so far been afforded the dip owners. It has been conclusively proved that this method of correction by trial, instead of by calculation, is not only expensive to the State, but is also unsuccessful.

"Steps are being taken to encourage the dip owner to acquire an intimate knowledge of the capacity of his dip, and to take a lively interest in the accurate measurement of all intentional and accidental additions and subtractions, and to discourage him from attemptimg to place upon the State the burden of maintaining his dip efficient.

"Attention in previous reports has been drawn to the changes in composition which dips undergo, particularly to the processes of oxidation and reduction.

"There appear to have been about 76 dips under observation during the year—the exact number is doubtful as samples from the same dip are sometimes sent over different signatures and the tracing of these is difficult —and in 47 of these the oxidation has not been very great, the quantity of arsenate formed not having at any time exceeded 25 per cent. of the amount of arsenite present. In 18 dips the arsenate reached a maximum exceeding 25 per cent. but not exceeding 50 per cent. of the arsenite, and in all dips a maximum of arsenate exceeding 50 per cent. was reached. In one case oxidation proceeded so far that there was actually at one period over 2½ times as much arsenate as arsenite present. The cycle of oxidation and reduction was in one case completed twice in the year, in two cases it took approximately nine months; several cases indicated a complete cycle in about 12 months, while in many cases the course of the changes was irregular, and the oxidation did not steadily proceed to a maximum followed by a continuous reduction.

"It has occurred in many cases that a dip has been kept in use long after it has become filthy and thick with dung and mud. There are not lacking indications that these dirty dips are inefficient, even when the analysis indicates a satisfactory arsenic content.

"It is highly probable that compounds of iron with arsenic are formed which have practically no toxic properties. Perhaps further experience will enable a more definite statement to be made as to the amount of mud, etc., which may be tolerated. Several cases of error in sampling have occurred—tins which have been used for measuring out Coopers dipping Fluid have been immediately afterwards used to take a sample from the dip; bottles with a quantity of rinsing water left in have been filled up

with the sample, etc. Cases have occurred where the results of analysis have given great surprise to the dip owners, and explanations have been demanded of the Analyst. In these cases the usual sources of error in sampling have been pointed out, and the owner has sometimes recognised one or other as the probable explanation, in other cases no explanation has been forthcoming excepting that some serious miscalculation has been made in making up the dip.

"Rinderpest.—Outbreaks of this disease occurred during the year in the settled areas of Lumbwa, Molo, Londiani, Njoro, Nakuru, Naivasha, Kedong, Ngong, Nairobi, Thika and Machakos. In suppressing these outbreaks the double inoculation method was used at Molo, Nairobi, Thika and Machakos. The other outbreaks were dealt with by the inoculation of serum only. The mortality from double inoculation has proved to be as small as in previous years and there is no doubt that this is the best method for dealing with the disease in this country, owing to the constant danger of the disease being reintroduced from infected native reserves, or through the migration of infected wild game.

"In September, 1915, the Veterinary Pathologist reported that instances had come under his notice which went to prove that the double inoculation of calves under six months old did not always result in the production of a permanent immunity to Rinderpest. A circular letter was therefore issued to all Veterinary Officers informing them that calves which are double inoculated for rinderpest when under the age of six months should not be considered immune and consequently should not be branded A M (this brand signifying active immunity). At a later period when such calves are over six months old they should be again double inoculated and branded as immune.

"A fresh outbreak of Rinderpest occurred amongst the cattle of the Samburu tribe, Northern Frontier District. A temporary quarantine station was therefore formed at Archer's Post and all trade cattle, awaiting release there, were injected with serum and passed on to Rumuruti Quarantine Station where they were again serumed before being passed on to the settled areas.

"At the Fort Ternan Quarantine Station 1,367 Military cattle and 2,328 cattle, the property of settlers and traders, were double inoculated during the year.

"The Laboratory issued the following quantities of serum during the year :—

To Military Authorities, East Africa	42,352
,, ,, Uganda	10,080
Veterinary Department, E.A. Protectorate ..	34,810
,, ,, Uganda	25,032
Settlers and Traders	3,500
Government of Nigeria	10,080
Total ..	125,854

"Anthrax.—Several cases of this disease occurred at Fort Ternan Quarantine Station amongst cattle undergoing quarantine after double inoculation for Rinderpest. The infection in many cases appeared to take place at the site of inoculation and in some cases infected animals lived for 20 days after developing symptoms. There is strong evidence to show that animals may be infected with the bacillus of Anthrax without clinical symptoms of the disease being apparent, and it has been demonstrated, that while this bacillus may be innocuous or at least non-fatal to a number of indigenous animals, the same bacillus may prove highly fatal to others.

"It is by this factor that we might assume Anthrax is carried from animal to animal in the process of double inoculation for Rinderpest. Many no doubt will miss infection, others though infected do not sicken, while others, again, contract Anthrax and die. Cases of anthrax also occurred amongst transport cattle working on the Mumias-Kisumu Road, and in the Nairobi and Kyambu Districts. As this disease is communicable to man and proves frequently fatal, animals intended for human consumption should be carefully inspected and temperatured before slaughter.

"Pleuropneumonia.—A few cases of Pleuropneumonia came under notice among the stock confiscated from the Turkhana. The precautions taken prevented animals from being moved to the settled areas.

"With regard to the quarantine area for this disease in the Masai Reserve every possible precaution is being taken to prevent the spread of the disease from this area, but owing to the large purchases of slaughter oxen which are being made from the Masai for Military purposes the owners of the infected herds may be tempted to evade quarantine restrictions and sell infected animals to the Military.

"Tuberculosis.—No cases of Tuberculosis have been reported this year.

"Contagious Abortion of Cattle.—This disease has come under notice on a few farms in the Molo, Nairobi, Naivasha and Machakos Districts, but it is of such an insidious nature and usually pursues such a mild course in native cattle that it is highly probable that it will be found to be much more widespread than is at present suspected. The disease spreads from farm to farm through infected cattle changing hands and too often unscrupulous farmers conceal the fact that their herds are infected to enable them to dispose of their stock. On the other hand, owing to the mild course it usually follows in native cattle, the disease may be present in a herd without the owner having suspected its existence.

"In Europe and other countries contagious abortion is a very serious disease from the stock breeders' and dairy farmers' point of view, and is the cause of enormous losses to owners of infected herds.

"It is probable that the disease in this country will be found to be a most serious one, should it appear in herds of grade cattle. It is therefore highly advisable that all cattle breeders should take every precaution to safeguard their herds against the disease. Rigorous preventive measures enable the disease to be effectually controlled only in herds that are well looked after, and experience in Europe and other countries goes to prove that for the present, effective legislation cannot be devised.

"The most practical method of preventing the introduction of this disease on to a farm is to submit all newly purchased breeding animals to some months' quarantine on an isolated portion of the farm before they are allowed to commingle with the animals of the homestead.

"In calf cows purchased should be calved down in isolated kraals and not allowed to leave these kraals until the animals have returned to normal health and all uterine discharge has ceased. Only then, after careful disinfection of the cows, should the stud bull be allowed access to them.

"A pamphlet dealing with the whole subject will shortly be issued by the Department.

"Trypanosomiasis.—An outbreak of Trypanosomiasis occurred in June, 1915, amongst settlers' cattle in the Thika District. A Veterinary survey was carried out over the whole district in July and August, when it was found that the disease was being largely disseminated through the agency of the common bloodsucking cattle fly (Stomoxys). The area implicated was placed in quarantine in September, 1915, and since then a Veterinary Officer has been permanently retained in the district, carrying out periodic examinations of all cattle; destroying all animals found to be affected with the disease. The measures to date have been instrumental in reducing the incidence of the disease and there is reason to believe that the disease will be eradicated along the transport routes in the near future when it will be possible to allow freer movement of cattle in the district.

"Foot and Mouth Disease.—An outbreak of this disease occurred at the Laboratory amongst cattle imported from Uganda. Prompt action was taken to segregate the affected herd, and any danger of the disease spreading to the Native Reserve was prevented, through the kindness of the Officer Commanding the Nairobi Defence Force, who kindly supplied an armed guard to patrol the infected area.

"This outbreak gave the Veterinary Pathologist an opportunity to satisfy himself in regard to the virulence of the Uganda form of this disease. It proved to be of a very benign type, and local stock possess a considerable resistance to it.

"Quarter Evil.—Outbreaks of Quarter Evil have been reported in Nyeri, Lumbwa, Nakuru and Kisumu Districts. A vaccine produced at the Laboratory has been used and has given good results.

"*Diseases of Equines.*—Glanders.—Cases of Glanders have occurred in one or two consignments of remounts from South Africa. By application of the Mallein test all affected animals were promptly discovered and destroyed.

"There should be little fear of this disease remaining in the country on account of the care that is being exercised to control and eradicate it

"Epizootic and Ulcerative Lymphangitis.—It is gratifying to find that very few cases of Epizootic Lymphangitis were noted during the year and there has been a great diminution in the number of Cases of Ulcerative Lymphangitis also. This decrease is mainly due to the fact that practically all the equines in the country came under Veterinary inspection during Military commandeering operations when most of the affected animals were either destroyed or sent to the Laboratory for treatment.

"There are a number of equines infected with Ulcerative Lymphangitis, however, still on the Uasin Gishu Plateau.

"The organism of Ulcerative Lymphangitis is present in the soil throughout the Protectorate. No good cause could be served by keeping this disease on the Schedule of notifiable diseases, and steps were taken to delete this disease from the Diseases of Animals Ordinance.

"Horse Sickness.—This disease was the cause of considerable mortality among Military remounts in the Nairobi, Mbagathi and Bissel Camps.

"Few cases have been reported by farmers during the year but this is probably not due to the disease being less prevalent than formerly, but because owing to the War, fewer animals are to be found on the farms.

"Strangles.—Several consignments of remounts from South Africa arrived at Kilindini infected with Strangles, the disease proving to be of an unusually virulent type. As great care is exercised to prevent any affected animals being sold at the sales of remounts there should be no risk of this disease appearing on farms.

"*Diseases of the Sheep and Goat.*—The principal diseases of the sheep and goat which have come under our notice during the year in the Military flocks have been Nairobi Sheep Disease, contagious foot-rot, verminous gastro-enteritis and contagious pleuro-pneumonia of the goat.

"*Diseases of the Pig.*—Two outbreaks of suspected East African Swine Fever were reported from Nyeri and the Uasin Gishu Plateau, respectively, but these were not confirmed.

"*Diseases of the Dog.*—An outbreak of suspected Rabies was reported from South Kavirondo, but the Veterinary Department had no opportunity to confirm the diagnosis.

"An outbreak was reported from Limoru, but as the suspected animals had been promptly destroyed, a diagnosis was not made."

A few details are added giving statistics regarding the permit system, live-stock importation, trading, branding of stock, together with some general remarks.

BRITISH EAST AFRICA. **Department of Agriculture. Annual Report of the Veterinary Pathologist for the Year ending 31st March 1916.** [MONTGOMERY (R. Eustace).]—pp. 72–75. Nairobi and Mombasa. Printed at The "Leader."

Unfortunately the greater portion of Montgomery's time during the year under consideration was taken up with work of military importance and thus we are deprived this year of the valuable and interesting information usually furnished in his reports. The present communication gives merely a summary of the results of the large amount of routine work performed at the laboratory. As usual the manufacture of anti-rinderpest serum was undertaken on a large scale, 204,480 doses being prepared during the year.

GOLD COAST. **Report on the Veterinary Department for the Year 1916.** —[O'DEA (M. E.), Acting Veterinary Officer).] 8 pp. f'cap. 1917. Accra: Government Press.

In the absence of a trained veterinary officer the work of the Veterinary Department for the year under consideration was carried out by a small staff under the supervision of a medical officer. This work consisted mostly in the routine inspection of cattle, sheep, and goats arriving at Coomassie, either for slaughter or transportation by rail or road to other towns near the Coast. A small amount of investigation work in connection with outbreaks of anthrax and rinderpest was performed by the medical officers. The brief accounts given regarding the diagnosis and methods of dealing with these diseases show a lack of trained knowledge regarding diseases of animals. A small outbreak of what was probably anthrax among stock passing through Salaga on their way from the Northern Territories was dealt with, apparently successfully. Numerous deaths occurred among horses and cattle travelling from the French dominions through the Northern Territories to the Coast; this epizootic was investigated by a medical officer who reported that this outbreak and other outbreaks in these regions could only be put down to rinderpest. The mortality, however, was much lower than that usually occurring in outbreaks of rinderpest in Europe and in the Transvaal. In spite of the presence of this disease along the cattle routes of the Northern Territories throughout the greater part of the year with its attendant mortality and dislocation of the cattle trade the number of cattle imported into Coomassie for 1916 was 14,799 as against 9,802 for 1915.

TRINIDAD and TOBAGO. **Report of the Government Veterinary Surgeon for the Year 1916.** [MILLER, J. Duncan]. 1 p. f'cap. 1917. Port-of-Spain: Government Printing Office.

This short report gives very little information regarding the diseases prevailing in the island of Trinidad. Most of the Government Veterinary Surgeon's time appears to have been taken up with inspection of live stock imported into the island chiefly from Venezuela. A few cases of anthrax occurred among cattle imported from that country but apart from that disease and strangles in American mules no contagious disease was observed in the imported animals. The island is free from rabies. The diseases observed in the island are stated to be for the most part due to metazoan parasites. A few cases of anthrax have occurred and several outbreaks of influenza among horses. A few details with regard to the prevailing diseases would be interesting.

UNION OF SOUTH AFRICA. **Department of Agriculture. Report of Veterinary Division. 1915-1916.** [GRAY (C. E.). Principal Veterinary Officer.] (Abridged Report in *Vet. Record.* 1917. Nov. 24. Vol. 30. No. 1533. pp. 209-213).

East Coast Fever.—This disease still constitutes the most important problem dealt with by the Veterinary Division and consideration of ts distribution in the various Provinces and the means adopted for ts eradication embrace about half of the present report.

In the Cape the position with regard to the disease has distinctly improved, the number of infected areas still remaining under quarantine having been reduced to six, included in two districts, and as there has been no serious mortality in these areas during the past twelve months there appears to be good reason for hoping that the disease will shortly be eradicated also from these districts.

In the Transvaal there are 8 districts infected with the disease but in most of these the infected areas are more or less circumscribed.

In Natal the position is by no means so favourable; the disease is so widely distributed that 28 magisterial districts are infected and only 6, which form a comparatively small portion of the total area of the Province, are shown as free from the disease. The situation is perhaps explained by the fact that although dipping tanks have been erected in very large numbers by the farming community this has been done in many cases not so much because the value of dipping has been appreciated but for the purpose of obtaining permits for the movement of cattle. Satisfactory progress is being made in the provision of dipping facilities in the native areas of Natal but the difficulties involved in dipping in such conditions are very considerable.

In the Transkei Territories the operations undertaken for the eradication of the disease in native territory have not yet reached a stage at which good results can be reasonably expected. Difficulty has been found in evolving a system which will induce native owners to dip their cattle. The disease, however, appears to have diminished, there having been only 31 fresh outbreaks as compared with 58 last year. In many districts the mortality amongst adult cattle is no longer serious because most of them have become immune either through inoculation or through having contracted the disease when young, but in all districts in which the disease has become established there is a heavy mortality among young stock, varying from 30 to 80 per cent., which keeps up veld infection and perpetuates the disease. In those districts in which European farmers have settled the position is better.

Dipping operations were seriously interfered with throughout the Union on account of the high price of dipping material; arsenite of soda was at one time unprocurable and thus for a time the dipping of cattle in infected areas was in danger of coming to a standstill. In the Cape Province there is a very unfortunate lack of interest in the erection of dipping tanks considering the constant liability to invasion with the disease. The position in the Transvaal is not better, although very considerable losses have been caused in the past. In Natal the number of tanks erected is relatively very much greater, though still insufficient, and it is hoped that in time the majority of farmers will appreciate the benefits of cattle dipping as a reward for their enterprise. In the Transkei the erection of tanks proceeds steadily; in the Orange Free State the number of tanks has also been nearly doubled.

Tuberculosis.—This comes next to East Coast fever in order of economic importance. Legislation has been introduced both for empowering the application of the tuberculin test overseas in the case of animals intended for import and also for dealing with reacting animals already imported from overseas. There is still a lack of co-operation between stockowners and the authorities which tends to defeat all efforts made by the Department to deal in a satisfactory manner with

outbreaks of disease. Details are given concerning the methods employed in dealing with outbreaks in the various provinces.

Anthrax.—The losses from this disease are believed to be even greater than those due to gall-lamziekte, which, however, engages the attention of farmers far more considerably. It is pointed out that the former is nevertheless a preventible disease which can be controlled and stamped out by inoculation. In the Cape Province the disease is extending and as no determined effort is made for its suppression the losses will probably be greater than they have been in the past. The employment of vaccins has in some instances been resorted to but much too late in the scene of outbreaks. It is also believed that better success would attend inoculation by increasing the volume of the doses. In the Transvaal and Orange Free State anthrax is becoming increasingly prevalent while in Natal and in the Transkei the losses have not been heavy.

Glanders.—The number of outbreaks recorded and dealt with were as follows :—Cape 22, Transvaal 63, Natal 9, Transkei 5, and Orange Free State 6.

Lung sickness.—There were no fresh outbreaks in the Cape Province. In the Transvaal there was one outbreak : 2 animals were destroyed and found to be infected but no further cases occurred among the in-contacts. In the Transkei two outbreaks were dealt with, neither of which was of much importance, only 3 animals being infected.

Equine scabies (mange).—In the Cape this disease was very prevalent in the vicinity of Port Elizabeth, but otherwise it gave very little trouble. In the Transvaal there were 5, Natal 11, Transkei 14, and Orange Free State 4 outbreaks.

Epizootic lymphangitis.—In the Cape five infected equines were destroyed ; in the Transvaal one animal was found infected and in Natal there were five outbreaks. The position so far as this disease is concerned has greatly improved of late years.

Contagious abortion.—The number of outbreaks reported was 31, distributed in Transvaal 8, Natal 10, Transkei 8, Orange Free State 5. The distribution and character of the disease is, however, admittedly very little understood, and no satisfactory method of dealing with it has been evolved.

Trypanosomiasis.—This does not appear to have spread to any extent outside the fly area.

Some short notes on the following non-proclaimed diseases were furnished by the Senior Veterinary Officer, Capetown [Dixon (R. W.)].

Blue-tongue in sheep.—This does not seem to have been very much in evidence except in the Western Province where in parts it was very prevalent. The diminution in frequency of the disease was attributed to the scarcity in rainfall during the year.

Ephemeral fever (*Three days' sickness*).—This disease was prevalent throughout the Province and in some districts it was particularly severe, as many as 40 to 50 animals in a herd being attacked at one time. Very few cases proved fatal.

Lamziekte.—Appears still to be confined to the sour grass veld area and cases among milch cows and heifers in calf make their appearance during prolonged drought.

Geel-Dikkop.—"This disease, which attacks both sheep and goats and is mainly confined to the Karroo districts, was prevalent this summer in the

Northern and North-Western Karroo districts, causing considerable mortality. It appears about the same time as blue tongue, although it is observed that, unlike blue tongue, when the rains are copious and persistent, geel dikkop is not so prevalent. Repeated rain showers followed by hot days are the weather conditions most favourable for its development.

"All attempts to produce the disease by inoculation have failed, also feeding experiments with suspected plants. As the true nature and cause of Geel-Dikkop are unknown, it is hoped that the Director of Veterinary Research will, by investigation, elucidate the cause.

"Medical treatment is found successful when the affected animals are treated early. . . .

"Geel-Dikkop has also been rather prevalent in the Orange Free State. There has been no opportunity of making any investigation respecting the so-called White Liver in sheep.

"*In the Transkei* the past horse-sickness season has been remarkably mild. The same applies to blue tongue. A peculiar form of bone disease in donkeys occurring in East Griqualand is now being investigated by the Research Division."

Further details are added concerning the duties and position of the Staff of the Veterinary Division.

Book Reviews.

Laveran (A.). **Leishmanioses. Kala-azar. Bouton d'Orient. Leishmaniose Américaine.**—iii + 521 pp. With 40 text figs. and 6 plates (2 coloured). 1917. Paris: Masson et Cie. [Price 15 francs].

Although 14 years only have passed since the discovery of *Leishmania donovani* and *L. tropica* a very large number of papers have been published on these protozoa and the diseases produced by them; these articles are, however, to be found distributed throughout a large number of periodicals which are often only obtainable with difficulty. Laveran thus believes that the time has come to summarise our actual knowledge concerning the leishmaniases. The present work is set out according to the following plan:—

(1) Leishmania and leishmaniases in general.

(2) Human visceral leishmaniasis or kala azar, caused by *Leishmania donovani*; infantile kala azar, which was formerly considered by a large number of observers as a morbid entity, is identified with Indian kala azar.

(3) Naturally-occurring canine visceral leishmaniasis, probably of the same nature as kala azar.

(4) Cutaneous leishmaniasis or oriental boil, caused by *Leishmania tropica*.

(5) American leishmaniasis of the skin and mucous membranes, which is described as a variety of ordinary cutaneous leishmaniasis or oriental boil.

As can be seen from the above summary the book refers mainly to conditions of interest in human tropical medicine, whereas hitherto only one of the domesticated animals, viz., the dog, has been definitely associated with these conditions. Inasmuch as the infection of this animal, however, is probably closely connected with that of human kala azar, especially in the case of infantile leishmaniasis, Laveran considers that a study of the subject is of interest to veterinarians as well as to medical men.

The leishmaniases are not new diseases. The Aleppo button or oriental boil was known towards the middle of the 18th century while kala azar, which was described for the first time in 1882, probably had existed for a long period in the mountains of Garo in India. But, although these human diseases had been recognised clinically, their etiology was not

discovered until 1903, when it was shown that kala azar and oriental boil were set up by micro-organisms, closely related to one another and belonging to a new genus of protozoa. Investigations carried out since that date have shown that leishmaniases are not rare diseases confined to a small number of districts in the tropics but on the contrary have a wide-spread distribution over the surface of the globe, not only in Asia and Africa but also in Southern Europe and a large part of South America, and probably the extent of our knowledge with regard to their geographical distribution is as yet by no means complete. Moreover, as they refer to diseases which run a chronic course and thus usually enable an affected subject to travel considerable distances opportunities may be given to observe them beyond the limits of the endemic or enzootic centres.

By far the greater part of the book refers to the above human diseases which have recently assumed considerable importance. The veterinarian will, nevertheless, find of great interest the chapter on generalities (pp. 1–44) and that on visceral canine leishmaniasis (pp. 279–303) as well as a couple of pages devoted to cutaneous natural leishmaniasis of the dog (pp. 344–346). In the chapter on generalities Laveran gives a clear and critical review of what has recently appeared in the literature concerning the history, geographical distribution, and clinical forms of leishmaniases, technique for the study of Leishmania, both by staining and by culture, and general morphology and biology of the Leishmania. The position of the Leishmania in the nomenclature of the protozoa is discussed in detail and attention is especially called to the hypotheses which suggest themselves as the result of the recent work of Fantham and A. Porter [see this *Bulletin*, 1916, Vol. 4, No. 4, p. 146] and Laveran and Franchini [see this *Bulletin*, 1914, Vol. 2, pp. 93 & 193]. According to Fantham and Porter the different species of Leishmania are probably insect flagellates which have become adapted to intra-cellular life in man and other vertebrate hosts and ordinarily propagate under a flagellate form but are capable of resuming the Herpetomas form in certain conditions (for example, in culture media). "From the phylogenetic point of view the relationship between Herpetomas of insects and Leishmania does not appear to be in doubt as can be judged from these experiments. From the point of view of nomenclature, as Minchin has pointed out, the evolution of Leishmania, which are intra-cellular parasites in the vertebrate host, appears too different from that of Herpetomas, which accomplishes the whole of its evolution in the digestive tract of insects, to enable one to amalgamate the two genera."

The following few remarks on the subject of natural canine leishmaniases are taken from the preliminary chapter:—

"Leishmaniases show themselves in the dog as in the case of man under two different forms: the visceral form and the cutaneous form.

"Canine visceral leishmaniasis is much the more common form. The principal and often the only symptom is furnished by wasting; in some animals one observes towards the end of the disease paresis of the hind quarters. The spleen which is almost always increased in size is sometimes very greatly hypertrophied. The disease terminates sometimes in recovery, sometimes in death with sub-normal temperature. It is especially in the bone marrow and next in the spleen and the liver where the Leishmania are found in largest numbers. Natural canine leishmaniasis is encountered in all the regions of the Mediterranean basin where kala azar is endemic; moreover, the Leishmania of the canine infection are indistinguishable morphologically from *Leishmania donovani*; the probabilities are therefore great in favour of the identity of visceral leishmaniasis of the dog with kala azar. This statement must, however, be taken with reserve; the relationship between the frequency of canine leishmaniasis and human leishmaniasis is inconstant; canine leishmaniasis is of common occurrence in regions where kala azar does not exist, and, on the other hand, it is altogether absent in India, that is to say, in the country where human kala azar rages with greatest intensity; in addition one seldom observes dogs infected with leishmaniasis in the habitations of human subjects affected with kala azar.

"Cutaneous leishmaniasis of the dog is encountered as a natural infection in certain parts of the world; it is particularly common in Teheran and

has been described in Aleppo, Turkestan, and the Caucasus. The descriptions given of this condition are very incomplete."

Experimentally the dog, the macaque, the white mouse, and some other small rodents are susceptible to infection with the viruses of kala azar and oriental boil.

It is, of course, unnecessary to discuss the merits of this book as regards style and masterly treatment of the subject dealt with. Laveran's writings are sufficiently known to all interested in tropical medicine, and the present work forms a companion volume well up to the high level set in the standard text book on "Trypanosomes and Trypanosomiasis."

J. T. E.

i. LEESE (A. S.) [M.R.C.V.S. (Temporary Captain, Army Veterinary Corps. Camel Specialist to Government of India, 1907 to 1913, and to Government of East Africa Protectorate, 1913–1914)]. **"Tips" on Camels for Veterinary Surgeons on Active Service**—50 pp. (Reprinted from "*The Veterinary Journal.*") 1918. Ballière, Tindall & Cox. [Price 2*s.* 6*d.* net.]

ii. CROSS (H. E.) [M.R.C.V.S., D.V.H., A.Sc. (Indian Civil Veterinary Department, Camel Specialist to the Punjab Government).] **The Camel and its Diseases. Being Notes for Veterinary Surgeons and Commandants of Camel Corps.**—viii + 151 pp. 1917. London: London: Ballière, Tindall & Cox. [Price 5*s.* net.]

The need for a small handy text-book on the more common camel diseases has now arisen owing to the employment of a number of veterinary surgeons, previously unacquainted with the peculiarities of the camel, in theatres of war where this animal figures largely as a means for transport and riding. No better authorities could have been chosen for the work than the above two authors who have been afforded ample opportunity for studying the camel in its native habitat and have already established their names in this connection on account of the reports and communications they have furnished from time to time.

i. This brochure embraces a series of articles which have recently appeared in the *Veterinary Journal.* In his preface the author states that "they were intended for the professional man, the idea being to supply such information on the diseases of camels as have not hitherto been accessible to veterinarians in a concise form, and to avoid long descriptions, both of well-known diseases like Sarcoptic mange, and of matters already quite familiar to the general veterinary practitioner; the subject is dealt with throughout on comparative lines." He concludes by saying that the "paper is admittedly only a superficial one, and has been written from memory only . . . in the back-country of Somaliland, and all my notes and records are at home. . . . No attempt has been made . . . to deal with anything but the male working camel from the point of view of the veterinary officer on active service; nor have I thought it necessary to mention certain diseases of purely local importance."

No apology need, however, be given for producing these notes at the present time and the author deserves well for placing in a condensed form the experience which he has acquired in various countries as the result of careful observation. The advice given throughout is set out in clear, unhesitating terms and should be of great value to the uninitiated in avoiding many errors which would otherwise occur. Vernacular names for diseases have been almost altogether avoided. There are signs in many places that a somewhat unnecessarily colloquial style of writing has been adopted. Indeed, perhaps the greatest possible fault of the book lies in its title. It appears quite unnecessary to place scientific advice intended for professional men on the same level as that obtainable from the parasites of a racecourse. In other places the author's expressions are somewhat ambiguous. For instance, in dealing with the surgical diseases,

he includes among "the characteristic camel-lamenesses of the fore-limb" such conditions as "punctured wounds of foot" and "fracture of radius." He must surely mean that these are the "more common" and not the "characteristic" surgical diseases of camels.

It is much to be hoped that some day the author will have access to his notes and records and thus compile a more careful systematic review of camel diseases.

ii. This small volume deals with camel management and diseases in a concise, systematic and comprehensive manner. The text is aided with a number of good photographs and the publishers' work throughout has been very well done. The descriptions are apparently applicable more particularly to conditions as they exist in India and native terminology is used to a considerable extent in the text; appendices are added on the vernacular names of diseases and of fodder fed to camels in the Punjab. The chapter on camel-breeding by Major G. E. M. Hogg, Commandant 54th Silladar Camel Corps, is written in a very light, somewhat airy style and should prove of some interest. A good deal of prominence is given to the author's own recent experiments on feeding and on the attempted transmission of haemorrhagic septicaemia and blackquarter to the camel.

J. T. E.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 3, pp. 214–220.]

PROTOZOAN PARASITES.

BÉKENSKY. Les Spirochètes des tractus intestinal des oiseaux. [Spirochaetes of the Intestinal Tract of Birds.]—*Bull. Soc. Cent. Méd. Vét.* July 5. *Rec. Méd. Vét.*, 1917. July 30. Vol. 92. No. 14. pp. 284–288.

HAHN (C. W.). On the Sporozoon Parasites of the Fishes of Woods Hole and Vicinity. III. On the *Chloremyxum clupeidae* of *Clupea harengus* (Young), *Pomolobus pseudoharengus* (Young), and *P. aestivalis* (Young).—*Jl. Parasit.*, 1917. Sept. Vol. 4. No. 1. pp. 13–20.

KAMM (Minnie Watson). Notes on Known Gregarines.—*Jl. Parasit.*, 1917. Sept. Vol. 4. No. 1. pp. 40–43. With 3 figs.

MARTOGLIO (F.). Su di un nuovo genere di parassiti del sangue. [A New Genus of Blood Parasite.]—*Ann. d'Igiene*, 1917. Sept. 30. Vol. 27. No. 9. pp. 561–563. With 1 plate.

ROGER (Henri). Les cas français de Sodoku, toxi-infection par morsure de rat. [French Cases of Sodoku—Toxi Infection by Rat-Bite.]—*Rec. Méd. Vét.*, 1917. July 15. Vol. 92. No. 13. pp. 376–378. [Extracted from *Presse Médicale*, 1917. Apr. 5.]

SAMPSON (S. E). Coccidiosis in the Horse.—*Vet. Record*, 1917. Sept. 29. Vol. 30. No. 1525. p. 131.

[A four-year-old horse was slaughtered at Sheffield on account of emaciation, and on post-mortem examination the mucous membrane of the small intestine was thickened and the mesenteric glands enlarged and congested. The mucous membrane was found invaded with "large numbers of a coccidian parasite" which was "circular in shape" and "measured only 3 mm. in diameter." (It seems incredible that a coccidium of such dimensions was discoverable as they by no means correspond with those of the coccidia pathogenic for the other domesticated animals.)—ED.]

SUSTMANN. Kokzidiose bei einem Dompfaff. [Coccidiosis in a Bullfinch.]—*Berlin. Tier. Woch.*, 1917. Sept. 27. Vol. 33. No. 39. p. 427.

SUSTMANN. Die Kokzidiose als Ursache des Jungtiersterbens unter den Kaninchen. [Coccidiosis as the Cause of Death among Young Rabbits.]—*Berlin. Tier. Woch.*, 1917. Aug. 23. Vol. 33. No. 34. pp. 375–376.

METAZOAN PARASITES.

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BEYRO (A. F.). Perjuicos causados por la Garrapata del Ganado Vacuno-Inmunizacion contra la Tristeza: Lo que se hace en Estados Unidos. [Losses of Cattle caused by Ticks: What is being done in the United States.]—*Anales Soc. Rural Argentina*, 1917. June 4. Vol. 51. No. 4. pp. 329–333. With 1 fig.

BRUCE (E. A.). A New Parasite for Cattle. The Larvae of *Eristalis Tenax L.* (Drone-Fly).—*Jl. Amer. Vet. Med. Assoc.*, 1917. Oct. Vol. 52. (New Series. Vol. 5.) No. 1. pp. 66–68. With 1 fig.

CAMERON (A. E.). The Relation of Soil Insects to Climatic Conditions.—*Agric. Gaz.* (Canada), 1917. Aug. Vol. 4. No. 8. pp. 663–669.

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FROGGATT (W. W. & J. L.). Sheep-Maggot Flies, No. 3.—*Dept. Agric. N.S.W., Sydney.* Farmers' Bull. No. 113. 1917. June. 37 pp. With 12 figs.

HERMS (William B.). Contribution to the Life-History and Habits of the Spinose Ear Tick, *Ornithodoros megnini.*—*Jl. Econom. Entomol.* 1917. Aug. Vol. 10. No. 4. pp. 407–411.

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IMES (M.). The Sheep Tick and its Eradication by Dipping.—*U.S. Dept Agric.* Farmers' Bulletin. No. 798. 1917. May. 31 pp. With 15 text figs.

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MENDOZA (P. de la C.). La Garrapata en el Paraguay. [The Tick in Paraguay.]—*Anales Soc. Rural Argentina*, 1917. May. Vol. 51. No. 3. pp. 251–253.

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[The subject-matter of the above paper has already been abstracted from another journal, see this *Bulletin*, Vol. 5, No. 1, pp. 48–52.]

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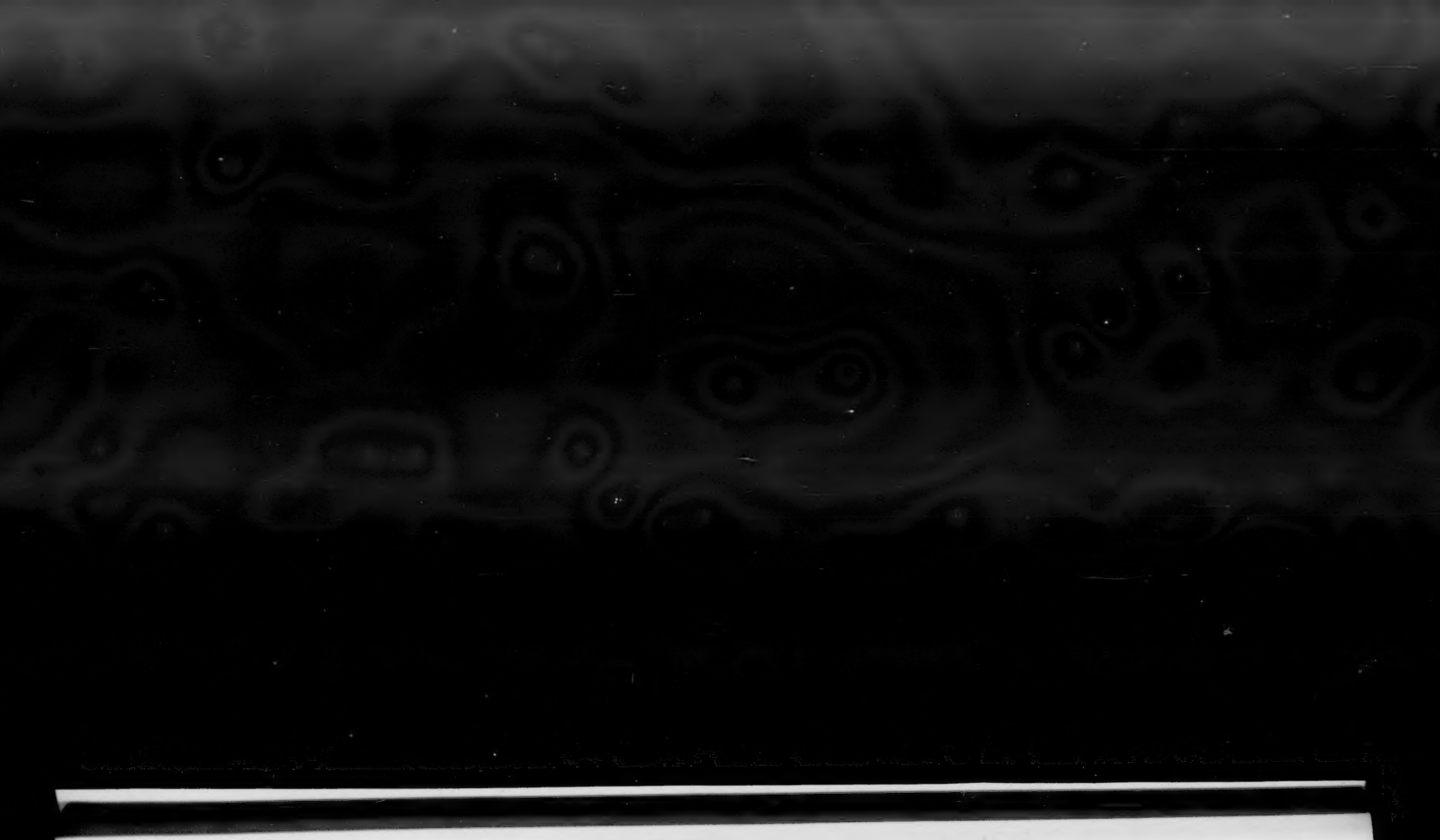
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